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October 31, 1990

Energy Research Abstracts

Abstracts 43651–46334

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of nonreport literature is limited to that generated by Department of Energy activity.**

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ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The GPO Stock Number is 061-000-00749-1 for the Volume 14 indexes.

Managing Editor, Audrey B. Smith
Technical Editor, Robert W. Rutkowski

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

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4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
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18. **Conference title, location, and date,** if applicable.
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21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89760060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-586 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (360-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

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Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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National Technical Information Service
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Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

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Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
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Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 39 first-level and the 308 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

0103 Preparation

43651 (DOE/PC/88853–T2-App.) **Air-sparged hydrocyclone/ advanced froth flotation fine coal cleaning: Appendices.** Pennsylvania Electric Co., Johnstown, PA (USA). [1990]. 360p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88853. Order Number DE90016411. Source: NTIS, PC A16/MF A01 - OSTI; GPO Dep.

Appendices are presented analytical data on advanced froth flotation tests and air-sparged hydrocyclone test. (CBS)

43652 (GAO/RCED–90-3) **Perspectives on the potential of clean coal technologies to reduce emissions from coal-fired power plants.** Fultz, K.O. General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 17p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses how emerging clean coal technologies can play an important role in reducing emissions from coal-fired power plants. A major issue is whether they will be commercially available for widespread deployment within the time frame needed to meet requirements of acid rain control legislation. On the basis of current reviews and past reports, it appears that clean coal technologies should contribute, but in all likelihood not significantly, to the nationwide reduction of acid rain during the next 15 years. Few utilities have plans to use clean coal technologies in this time frame, and although utilities indicated that they would give much greater consideration to using such technologies if acid rain control legislation were enacted, the technologies are generally not expected to penetrate the market within the next 15 years. Greater emphasis on funding multiple demonstrations of the more promising clean coal technologies could accelerate their successful demonstration and allow them to play a greater and more timely role in reducing acid rain-causing emissions.

0104 Processing

Refer also to citation(s) 43695, 43717, 43762, 44062, 44089, 44419, 44428

43653 (CONF-900853–1) **Gas separations using inorganic membranes.** Egan, B.Z. (Oak Ridge National Lab., TN (USA)); Singh, S.P.N.; Fain, D.E.; Roettger, G.E.; White, D.E. Oak Ridge National Lab., TN (USA). [1990]. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. From Gasification and gas stream cleanup systems; Morgantown, WV (USA); 28-30 Aug 1990. Order Number DE90015795. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this project is to explore the applicability of inorganic membranes to separate gases at high temperatures and pressures and/or in hostile process environments encountered in fossil energy conversion processes such as coal gasification. The overall program will develop porous inorganic membranes and apply porous membrane technology to the separation of gases present in coal gasification processes. Successful completion of the program could lead to the development of processes that would improve the economics of fossil energy conversion processes by significantly reducing gas cleanup and separation costs. This quarter, the permeability of alumina membranes was evaluated. 2 refs., 7 figs.

43654 (CONF-900958–2) **Combustion reactivity of mild-gasification chars.** Daw, C.S. (Oak Ridge National Lab., TN (USA)); Perna, M.A. Oak Ridge National Lab., TN (USA). [1990]. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. From 7. annual international Pittsburgh coal conference; Pittsburgh, PA (USA); 10-14 Sep 1990. Order Number DE90015794. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We summarize laboratory combustion reactivity evaluations of mild- gasification chars from four candidate processes. The chars are compared with each other as well as with more conventional boiler fuels. Our results demonstrate that mild-gasification char combustibility varies widely and is a function of both the parent coal and the mild-gasification process severity. 15 refs., 4 figs., 4 tabs.

43655 (CONF-8809162–3) **Studies on coal devolatilization and char reactivity under PFBC [pressurized fluidized-bed combustion] conditions.** Warchol, J.J.; Shiao, S.Y.; Chandran, R.R. Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. [1988]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC23247. From Advanced Research and Technology Development (AR&TD) direct utilization, instrumentation, and diagnostics contractors review meeting; Pittsburgh, PA (USA); 6-9 Sep 1988. Order Number DE90015987. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this project is to obtain fundamental combustion data on coal devolatilization and char reactivity under PFBC conditions. The data collected will be used to model coal combustion at high pressure. Rate constants for the reactions taking place will be derived. The information obtained in this study will be of use to those developing comprehensive PFBC performance models and advancing second-generation PFBC designs. The major accomplishments of this project thus far include the design, fabrication, and shakedown of a bench-scale PFBC facility that meets ASME code requirements. The reactor is presently operational and has been tested with coals at pressures as high as 220 psig and temperatures of 1650°F. 7 figs., 2 tabs.

43656 (DOE/MC/23075–2865) **Measurement and modeling of advanced coal conversion processes: Fourteenth quarterly report, January 1–March 31, 1990.** Soloman, P.R.; Serio, M.A.; Hamblen, D.G.; Smoot, L.D.; Brewster, B.S. Advanced Fuel Research, Inc., East Hartford, CT (USA); Brigham Young Univ., Provo, UT (USA). 1990. 153p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC23075. Order Number DE90016198. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The overall objective of this program is the development of predictive capability for the design, scale up, simulation, control and feedstock evaluation in advanced coal conversion devices. Toward this goal, work continued on the following projects: coal to char chemistry submodel; fundamental high-pressure reaction rate data; secondary reaction of pyrolysis product and burnout submodels; ash physics and chemistry submodel; large particle submodels; large char particle oxidation at high pressures; SO_x–NO_x submodel development; integration of advanced submodels into entrained-flow code, with evaluation and documentation; comprehensive fixed-bed modeling review, development evaluation and implementation, generalized fuels feedstock submodel; application of generalized pulverized coal comprehensive code; and application of fixed-bed code.

43657 (DOE/MC/23293–2856) **Experimental development of a multi-solid fluidized bed reactor concept: Final report.** Litt, R.D.; Paisley, M.A.; Tewksbury, T.L. Battelle Columbus Div., OH (USA). Feb 1990. 75p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC23293. Order Number DE90009673. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Battelle's Columbus Division is developing a coal mild gasification process based upon the Multi-Solid Fluidized bed reactor system to produce high quality liquid and gaseous products. This process uses 2-stages to gasify coal at high throughputs to produce a range of products in compact reactors without requiring an oxygen plant. 8 refs., 14 figs., 12 tabs.

43658 (DOE/MC/24116–2867) **Development of an advanced, continuous mild gasification process for the**

production of co-products: Quarterly report, October 15, 1989–January 15, 1990. Wright, R.E.; Durney, T. Coal Technology Corp., Bristol, VA (USA). Feb 1990. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC24116. Order Number DE90016301. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective of this project is to develop an advanced continuous mild gasification process and product upgrading processes which will be capable of eventual commercialization. The program consists of four tasks. Task 1 is a literature survey of mild gasification processes and product upgrading methods and also a market assessment of markets for mild gasification products. Based on the literature survey, a mild gasification process and char upgrading method will be identified for further development. Task 2 is a bench-scale investigation of mild gasification to generate design data for a larger scale reactor. Task 3 is a bench-scale study of char upgrading to value added products. Upon successful completion of Task 2 and Task 3, optional Task 4 will be implemented in which a 1000 pound per hour demonstration facility will be built and operated. Task 4 also includes a technical and economic evaluation based on the performance of the mild gasification demonstration facility. This quarter, char coking tests were continued in the effort to find the proper conditions to make form coke that will meet commercial specifications for metallurgical coke. New facts were obtained showing the effect of briquette composition, coking heat rates and other factors on coke specification such as CSR, CSI and stability. There is still a gap between the actual specifications and desired specifications. After thorough consideration the decision was made to adopt an interfolded twin screw design for the continuous reactor. 3 refs., 3 figs., 6 tabs.

43659 (DOE/MC/24268–T3) **Development of an advanced mild gasification process: Final report.** Riley Stoker Corp., Worcester, MA (USA). Riley Research Center; University of Wyoming Research Corp., Laramie, WY (USA). Western Research Inst. [1990]. 96p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC24268. Order Number DE90015079. Source: NTIS, PC A05/MF A01 - OSTI.

Riley Research Center designed, fabricated, assembled and purchased equipment to erect a skid-mounted 100 LBM/HR continuous mild gasification test unit at the Riley R&D Center in Worcester, Massachusetts. Riley partially disassembled the unit and transported the sub-assemblies, parts, and equipment to Western Research Institute, North Site, Laramie, Wyoming. Riley assisted WRI during erection and WRI completed the construction and shakedown of the unit. Crushed Wyoming coal, having a moisture content of 25% to 30%, is fed into an inclined fluidized bed dryer which uses recycled, heated carbon dioxide sweep gas to remove the moisture. The dried coal passes through an inclined fluidized bed gasifier using recycled product sweep gas to remove volatile hydrocarbons and produce char. Western Research Institute has successfully demonstrated that this test unit can produce char from Wyoming coal. This report is a summary description of the design of the 100 LMB/HR continuous mild gasification process demonstration unit with regards to flow process, inclined fluidized beds, and condensers. 20 figs., 10 tabs.

43660 (DOE/PC/79928–T10) **Solid superacids as coal liquefaction catalysts: Quarterly report, April 15, 1990–June 15, 1990.** Tierney, J.W.; Wender, I. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. 20 Jun 1990. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79928. Order Number DE90015142. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimental work continued on the use of solid superacids for direct liquefaction of a high volatile bituminous Illinois No. 6 coal and Pittsburgh Seam 8 coal. Solid superacids of iron ($Fe_2O_3 \cdot SO_4^{2-}$) containing small amounts of sulfate (2–7 wt %) were used for the liquefaction. They were also used with added sulfur. The amount of sulfur added was enough for complete in situ sulfidation of the metal oxides. Both sulfated and unsulfated forms of iron oxide gave essentially the same conversion, but the sulfated iron oxide gave more lightly oils than the unsulfated iron oxide. Characterization of the coal liquefaction residues was also carried out. Mossbauer spectroscopy was used for determining the composition of the active catalytic phases formed at the reaction conditions. A bimetallic $MO/Fe_2O_3 \cdot SO_4^{2-}$ catalyst (1 wt % Mo wrt Fe_2O_3) was prepared and used for direct liquefaction of Illinois # 6 and a Pittsburgh Seam 8 coals. A total conversion of 86 wt % was obtained with 68 wt % yield of oils when 50 ppm of molybdenum was used together with 3500 ppM of iron (in the form of a catalyst mentioned above) for the liquefaction of Illinois # 6 coal at 400°C and 1000 psig hydrogen. 2 figs., 2 tabs.

43661 (DOE/PC/80518–T13) **Oxidation of NiAl(110).** Brown, W.W. Montana State Univ., Bozeman, MT (USA). Oct 1989. 68p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-85PC80518. Order Number DE90015645. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The oxidation of nickel aluminium is a relatively unstudied process. We present a study on the oxidation of nickel aluminum specifically the (110) surface. We have studied the oxidation of NiAl(110), utilizing the following measurements: auger electron spectroscopy, x-ray photoelectron spectroscopy, surface second harmonic generation, and work function change. We have found that oxygen is weakly incorporated on the NiAl(110) surface. The oxygen that is absorbed interacts with the aluminum in the substrate, exclusively, forming an aluminum oxide. Although, the oxide formed is geometrically or chemically different than Al_2O_3. There is little or no direct interaction between the nickel in the substrate and the adsorbed oxygen. Indirectly, the nickel effects the sticking coefficient, weakening the incorporation of the oxygen and the surface. We feel the first stage of adsorption is surface followed by subsurface incorporation. The oxygen is bound weakly enough that the oxygen on the surface is desorbed when the exposure stops and a diffusion process causes the oxygen from the bulk to migrate to the surface region. 42 refs., 28 figs.

43662 (DOE/PC/80518–T14) **Incipient oxidation of Al(111) studied using optical second harmonic generation.** Wan, Kejia. Montana State Univ., Bozeman, MT (USA). Apr 1989. 98p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-85PC80518. Order Number DE90015646. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Optical second harmonic generation and complementary surface analytical techniques have been used to study the oxidation of the Al(111) surface. Two aspects of the oxidation properties are investigated. The first is the identification of oxide growth phases. When oxygen adsorbs on the Al(111) surface, oxygen bonds initially in two distinct sites such that both a surface phase and a subsurface phase exist on the surface prior to the formation of Al_2O_3. Auger electron spectroscopy, contact potential difference work function measurements and second harmonic generation support this conclusion. Additionally, the second harmonic generation and contact potential difference data indicate that two types of bonds between the adsorbed oxygen and the substrate aluminum with increasing exposure. At low oxygen coverage, the bond is serves to reduce the density of free electrons of the substrate surface. At higher oxygen exposures, charge transfer occurs from the aluminum to the oxygen atoms. This transfer produces a localized, permanent contribution to the surface dipole moment. 60 refs., 24 figs.

43663 (DOE/PC/80518–T15) **Surface chemistry of model cobalt-molybdenum catalysts supported on planar γ-Al_2O_3.** Kirkpatrick, T.D. Montana State Univ., Bozeman, MT (USA). Jun 1986. 90p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-85PC80518. Order Number DE90015647. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Cobalt-molybdenum catalysts supported on γ-Al_2O_3 are well known for their success in the hydrotreating of petroleum feedstocks and coal liquifaction products. Their surface structure has been studied by several methods including recent attempts by surface science techniques. This study presents an alternative approach by replacing the porous γ-Al_2O_3 supports with planar γ-Al_2O_3 grown on aluminum substrates. Preparation of the model catalysts was performed completely in situ. The γ-Al_2O_3 was prepared by thermally oxidizing the planar, polycrystalline aluminum substrates. The molybdenum and cobalt were vapor deposited to approximately monolayer coverage and subsequently oxidized. The planar model catalysts were characterized by ESCA, SIMS and AES and their surface structure compared to that of industrial catalysts. The ESCA Al 2p band was used to monitor the oxidation of

the aluminum. Shifts in the binding energy enabled differentiation between amorphous and crystalline Al_2O_3. Subsequent deposition and oxidation of molybdenum resulted in broadening and binding energy shifts of the Al 2p and Mo 3d bands suggesting interaction between the molybdenum and the molybdenum and the γ-Al_2O_3. 41 refs., 24 figs., 8 tabs.

43664 (DOE/PC/90529–T3) **Micropore diffusion in coal chars under reactive conditions: Final technical report.** Perkins, M.T.; Calo, J.M. Brown Univ., Providence, RI (USA). Div. of Engineering. Jun 1990. 204p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90529. Order Number DE90015669. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This study is concerned with the development and application of a technique for the measurement of characteristic diffusion times of various relevant gaseous species in the micropore structure of coal chars. The method is based on the analysis of the transient response of a well-mixed reactor system to a concentration forcing function. The characteristic micropore diffusion time was measured under near-reaction conditions using the technique developed here. The diffusion of CO_2, CO, and CH_4 is activated over the temperature range examined (298K–1100K) while that of N_2 and Ar is not. A decrease in apparent activation energy for CO_2 and CO at high temperatures suggests that a two phase diffusion model applies in part for these species. CO_2 diffusion times exhibit an increase with pressure, as predicted by an occluded phase model. The effects of mineral matter and surface oxygen complexes were also investigated. An effectiveness factor analysis, using measured diffusion times and reactivities, indicates that the coal char-CO_2 reaction is mass transport-controlled for all of the coal chars examined. A Monte Carlo computer model of activated diffusion in overlapping, cylindrical pores was also developed. Activated diffusion is simulated by a mobile gas and an adsorbed surface phase. 130 refs., 73 figs.

43665 (DOE/PC/90533–10) **Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, December 16, 1988–March 15, 1989.** Bartholomew, C.H. Brigham Young Univ., Provo, UT (USA). 11 Aug 1990. 15p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90533. Order Number DE90015530. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes recent progress in a fundamental, three-year investigation of carbon formation and its effects on the activity and selectivity of promoted iron catalysts for FT synthesis, the objectives of which are: determine rates and mechanisms of carbon deactivation of unsupported Fe and Fe/K catalysts during CO hydrogenation over a range of CO concentrations, Co:H_2 ratios, and temperatures; and model the rates of deactivation of the same catalysts in fixed-bed reactors. The project will be divided into the following tasks: determine the kinetics of reaction and of carbon deactivation during CO hydrogenation on Fe and Fe/K catalysts coated on monolith bodies; determine the reactivities and types of carbon deposited during reaction of the same catalysts from temperature-programmed-surfaced-reaction spectroscopy (TPSR) and transmission electron microscopy (TEM). Determine the types of iron carbides formed at various temperatures and H_2/CO ratios using x-ray diffraction and Moessbauer spectroscopy; and using a reaction model for FT synthesis developed in this laboratory, the kinetics of reaction and deactivation measured in Task 1, and models of fixed-bed reactors from others workers, develop mathematical deactivation models which include heat and mass transport contributions for FT synthesis in packed-bed reactors. This quarter, design of software for a computer-automated reactor system to be used in the kinetic and deactivation studies was continued. Further progress was made towards the completion of the control language, control routines, and software for operating this system. Progress was also made on the operating manual and testing of the system hardware and software. 47 refs.

43666 (DOE/PC/90533–11) **Deactivation by carbon of iron catalysts for indirect liquefaction: Quarterly technical progress report, March 16, 1989–June 15, 1989.** Bartholomew, C.H. Brigham Young Univ., Provo, UT (USA). 11 Aug 1990. 15p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90533. Order Number DE90015531. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the eleventh quarter design of software for a computer-automated reactor system to be used in the kinetic and deactivation studies of iron catalysts for Fischer-Tropsch synthesis was continued. Further progress was made toward the completion of the control language, control routines, and software for operating this system. Progress was also made on the operating manual and testing of the system hardware and software. The PI, one associate and 2 students attended the Eleventh North American Meeting of the Catalysis Society held May 7–11 in Dearborn, Michigan and presented 3 papers. The PI presented a short course on Catalyst Deactivation at BYU on May 24– 26 and at Amoco on May 31–June 2. He and one associate and 2 students also attended a conference held June 14th at Snowbird on Spectroscopy of Coal. 47 refs.

43667 (DOE/PC/90533–12) **Deactivation by carbon of iron catalysts for indirect liquefaction: Annual technical progress report, September 16, 1988–September 15, 1989.** Bartholomew, C.H. Brigham Young Univ., Provo, UT (USA). Catalysis Lab. 15 Aug 1990. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90533. Order Number DE90015665. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes recent progress in a fundamental, three-year investigation of carbon formation and its effects on the activity and selectivity of promoted iron catalysts for Fischer-Tropsch (FT) synthesis, the objectives of which are: determine rates and mechanisms of carbon deactivation of unsupported Fe and Fe/K catalysts during CO hydrogenation over a range of CO concentrations, CO:H_2 ratios, and temperatures; model the rates of deactivation of the same catalysts in fixed-bed reactors. This quarter, progress was made toward completion of a systems manual for the automated Berty reactor system; system testing was also initiated. CO hydrogenation activity/selectivity tests were conducted on a new alumina-promoted iron catalyst Fe-A-201 at a H_2CO ratio of 3 in the temperature range of 200–230°C over a period of 150 hours. The specific activity of this catalyst was the same within experimental error as previously tested unsupported, unpromoted iron catalysts; however, this new alumina-promoted catalyst was found to have greater thermal stability against sintering upon rereduction in hydrogen. Long term tests are consistent with loss of specific activity and an increase in methane selectivity due to carbon deposition after reaction at 230°C. During Quarters 10–12 design of software for a computer-automated reactor system to be used in the kinetic and deactivation studies was continued. Further progress was made toward the completion of the control language, control routines, and software for operating this system. Progress was also made on the operating manual and testing of the system hardware and software. 48 refs., 8 figs., 3 tabs.

43668 (EUR–12061-EN) **Co-production of liquid iron and synthesis gas in smelting reduction.** Robson, A.L. British Steel Corp., Middlesbrough (UK). 1989. 59p. Source: Commission of the European Communities, Luxembourg.

Coal-based smelting reduction experiments have been carried out using a specially designed reactor to develop a process route for the co-production of liquid iron and a predominantly sulphur-free synthesis gas. Steady state operating conditions of constant bath carbon and temperature were achieved over extended operating periods with continuous additions of directly reduced iron (dri), iron ore, coal and oxygen into a liquid iron bath. Coal injection rates of up to 0.4 t/h per tonne of liquid iron bath have been achieved. Mixed feeds containing different ratios of dri: iron ore have demonstrated the capability of achieving product flexibility with liquid iron production rates varying between 400 kg/h and 1 200 kg/h. The gas composition has been typically 50-60% CO, 15-20% H_2, ~10% CO_2, ~ 10% N_2. Sulphur levels in the gas of around 500 ppm have been determined from mass balance calculations with the majority of the sulphur leaving in the gas phase reacting with the iron bearing fume. A thermal model describing the pilot-plant operation has achieved close correlation between predicted bath temperatures and plant measurements. An engineering feasibility study has been carried out detailing the key components of an

intermediate-sized steel works-based demonstration plant producing 5 t/h of liquid iron and up to 8 x 10^3 Nm^3/h of synthesis gas for a mixed charge of scrap, iron ore, coal and oxygen. Capital and operating costs have been estimated for the demonstration plant, together with projections for capital and operating costs of a commercial unit producing 50 t/h of liquid iron and 8 x 10^4 Nm^3/h of synthesis gas. 17 figs., 11 tabs.

43669 (EUR–12211) **Westfield slagging gasifier project: Demonstration project: Final report.** Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; British Gas PLC, London (UK). 1989. 53p. Sponsored by Commission of the European Communities. Contract LG 01/6/80. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The development of the slagging gasifier by British Gas and Lurgi at the Westfield Development Centre, Scotland, has been in progress since 1975. Two phases of the work programme supported by the EEC (Phase II and IIIa) are covered in detail in this report. The overall technical objectives are to acquire the performance and operability data to enable commercial slagging gasifiers to be designed and operated to meet predicted engineering and performance guarantees. Specific objectives are: to obtain product yield and performance data on a range of selected coals; to study the influence on performance of feedstocks and operating design variables; to establish the effect of scale-up; to demonstrate that the slagging gasifier can be operated on bituminous coals containing a high proportion of fines (approximately 50%); to demonstrate the long term operability and performance of the gasifier and the reliability of proprietary equipment. 23 figs.

43670 (EUR–12215) **Hydrogenating extraction of coal: Final report.** Ben Nasr, H. (Krupp (F.) GmbH Forschungsinstitut, Essen (Germany, F.R.)); Haeffner, E. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 29p. Sponsored by Commission of the European Communities. Contract EN3V-0014D. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The aim of the R&D project was to develop a process to recover liquid fuels or chemical feedstocks by continuous extraction of coals with supercritical water vapour. The necessary process conditions to convert coal into oil-like products at sufficient rates by using supercritical water vapor are: pressures $\geq$221 bar and temperatures $\geq$374°C. The high pressure make it necessary for a special lock-hopper system to be developed. One of the most important aims of this R&D project therefore is to develop a lockhopper system for 320 bar and 450°C capable of feeding and discharging coarse solids into pressurized spaces and thus be able to advance into pressure and temperature ranges which are typical for continuously operating thermal coal conversion plants. Tests performed on bituminous coal are described. 20 refs., 7 figs., 7 tabs.

43671 (EUR–12215-EN) **Hydrogenating extraction of coal.** Ben Nasr, H.; Haeffner, E. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 30p. Source: Commission of the European Communities, Luxembourg.

The aim of this project was to develop a process to recover liquid fuels or chemical feedstocks by continuous extraction of coals with supercritical water vapour. One of the most important objectives was to develop a lock-hopper system for 320 bar and 450°C capable of feeding and discharging coarse solids into pressurised spaces and thus to be able to advance into pressure and temperature ranges which are typical for continuously operating thermal coal conversion plants. In parallel with development work on the lock-hopper system, batchwise tests were carried out to investigate the behaviour of various coals under extraction conditions. These showed that the yield of extracted bitumen-like products is in excess of the content of volatiles according to the German norm DIN 51720 although in each case the extraction residues still contained volatile matter. Although it was not possible to run continuous long-time tests, exploratory tests using extraction residues were performed. These showed that the same design concept can be applied without difficulty to the discharge of extraction residue from soft brown coal employed as feed. Difficulties were encountered in discharging extraction residues from bituminous or black coal and hard brown coal.

43672 (EUR–12257) **The evaluation of cokes as filter aids in direct coal liquefaction: Final report.** Jones, M.A. (Coal Research Establishment, Cheltenham (UK)); Pass, R. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 46p. Sponsored by Commission of the European Communities. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The separation of inert solids associated with the coal feed is an essential operation within all direct coal liquefaction processes. Hot, pressurized filtration is considered to be one of the most efficient methods of achieving this separation. Good filtration performance has been achieved during development of the British Coal Liquid Solvent Extraction (LSE) process but regular cleaning of the filter screen is required in order to extend screen life to an acceptable value. It has been shown that the required frequency and severity of the cleaning process may be reduced by the use of mineral precoats. Using established carbonization techniques cokes were prepared by rapid heating of coal and liquefaction products. This technique is expected to produce distended particles which will have good filter bridging properties, produce a porous filter cake and will lead to clean filtrates when used as body feed materials. Other cokes included in this investigation were made by British Coal by delayed coking methods and some were obtained from petroleum coke producers. 7 refs., 26 figs., 12 tabs.

43673 (EUR–12257-EN) **The evaluation of cokes as filter aids in direct coal liquefaction.** Jones, M.A.; Pass, R. British Coal Corp., Stoke Orchard (UK). Coal Research Establishment. 1989. 46p. Source: Commission of the European Communities, Luxembourg.

One of the major problems experienced in the development of filtration for coal liquefaction is the rapid clogging of fine metal filter screens. Tests have shown that the screens could be cleaned in situ and the frequency of such cleaning could be reduced by using precoats. Standard diatomaceous precoats could be used but these are expensive and their use could reduce the thermal value of the filter cake. Various carbonaceous products derived from coal and petroleum have been suggested as alternatives. Sixteen samples of coke have been assessed in laboratory tests. All have a good performance in terms of low cake resistivities, screen bridging, and effected considerable protection for metal screens against clogging. When used in plant tests as a 5mm precoat the petroleum coke fines effected a doubling of the intervals between in situ cleaning (sluicing) and also were resistant to particle breakdown during slurry recycle. Coal extract coke and carbonised coal used as filter aids in plant tests also doubled the interval between in situ cleaning, but they behaved similarly to celite in the breakdown tests, being inferior to cyclone fines in this respect. The use of carbonaceous materials as body feed leads to a marked decrease in filter cake resistivity and, therefore, to an increased efficiency of filtration area.

43674 (EUR–12263) **Belgo-German experiment on underground gasification: Demonstration project: Summarized final report.** Chandelle, V. (Institution pour le Developpement de la Gazeification Souterraine, Liege (Belgium)); Li, T.K.; Ledent, P.; Patigny, J.; Henquet, H.; Kowol, K.; Masson, G.; Mostade, M. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Institution pour le Developpement de la Gazeification Souterraine, Liege (Belgium). 1989. 109p. Sponsored by Commission of the European Communities. Contract LG 02/1/78. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 10.

This report describes an underground gasification project at the Thulin deposit inside the Western Hainaut Coalfield within the South Belgian Coal Belt. The following topics are discussed: the test site; opening of the deposit by vertical wells; permeability investigation;

reverse combustion tests for linking two wells; application of special drilling techniques; gasification tests; instrumentation; and corrosion of well completion elements. 46 figs., 3 tabs. (CBS)

43675 (EUR–12263-EN) **Belgo-German experiment on underground gasification.** Chandelle, V.; Li, T.K.; Ledent, P.; Patigny, J.; Henquet, H.; Kowol, K.; Masson, G.; Mostade, M. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 110p. Source: Commission of the European Communities, Luxembourg.

The main objectives of the project were to prove, in a coal seam at 860 m depth, that it was possible to carry out an initial in-seam linkage between two vertical wells by reverse combustion, and to follow this operation with gasification by a mixture of air and steam. After many attempts to create a channel by reverse combustion, a new concept was demonstrated, based on the use of directional drilling techniques. After having carried out a controlled deviation with a small radius of curvature from one well, an in-seam horizontal drainhole was drilled and connected to the second well by sidetracking. The gasification stage proper took place between October 1986 and April 1987. The material balance for this period showed that 350 tonnes of coal had been affected of which 150 tonnes had been completely converted. This phase was characterised by the use of high pressures, by the use of a gasifying agent which included oxygen and foamy water as reactants, and by the production of a gas with a high methane content. The gas quality was excellent but the recovered flows were low. Overall, a new concept of gasification has been demonstrated in the Thulin in-situ trial in which the underground gasification of deep coal has been shown to be technically feasible.

43676 (EUR–12328) **Coal-water slurry contribution to the European Economic Community's energy: A technical and economic study: Demonstration project.** Variali, B. (Rome Univ. (Italy). Dept. of Chemical Engineering). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 452p. Sponsored by Commission of the European Communities. Contract 87-B-7010-11-1-17. Source: NTIS (US Sales Only), PC A20/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 37.50.

Coal-water slurry is a technology recently developed with the purpose of making coal use more practical and environmentally acceptable, particularly in the "clean" formulation. Intensive research and extensive testing has permitted from the one hand to develop slurry formulations suitable for practical use and, from the other, to ascertain the feasibility of existing equipment adaption to CWS-firing. In particular, the boiler can be retrofitted in order to allow combustion of CWS, while the firing system and transportation and handling equipment originally designed for liquid fuels require only minimal design adaption. This work outlines the present status of CWS technology and provides guidelines and details concerning power plants adaption. An interesting potential market for CWS has been found to exist in the European Economic Community. The industrial, the utility and the residential/commercial sectors allow the replacement of substantial amounts of traditional oil-derived and gaseous fuels with CWS, thus giving a valuable contribution to European Economic Community energy and respecting the environment protection rules, particularly when adopting the Premium Fuel formulation. 137 refs., 43 tabs.

43677 (EUR–12355) **Development of a computer package for the calculation of direct coal liquefaction process economics: Final report.** Topper, J.M. (Coal Research Establishment, Cheltenham (UK)); Cross, P.J.I.; Goldthorpe, S.H.; Rule, J.D. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 44p. Sponsored by Commission of the European Communities. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

Of particular value to research into coal utilization processes is software which enables process and economic studies to be carried out interactively on personal computing equipment. A computer software system has been developed under the name of ACCESS, an acronym for A Coal Conversion Economics Simulation System. The software system development involved three principal activities: simplification of the ARACHNE technical evaluation software previously developed by British Coal, to provide a flowsheeting program of the appropriate level of sophistication for the present application; development and testing of programs for the representation of process capital costs and integration of these programs with the flowsheeting program; and development and testing of programs to perform overall economic evaluations, including parametric studies, and integration of these programs with the flowsheeting and capital costing programs. 16 figs., 3 tabs.

43678 (EUR–12355-EN) **Development of a computer package for the calculation of direct coal liquefaction process economics.** Topper, J.M.; Cross, P.J.I.; Goldthorpe, S.H.; Rule, J.D. British Coal Corp., Cheltenham (UK). Coal Research Establishment. 1989. 48p. Source: Commission of the European Communities, Luxembourg.

This report describes the development of a computer software system which enables the user to create, modify and run simple flowsheeting models of the thermodynamic performances of direct liquefaction processes. The system also provides a framework for the user to develop economic information, including capital and operating costs, for the processes of interest. In addition, it enables the user to carry out parametric studies on the effects on process economics of altering process variables or the assumptions used in defining the thermodynamic performance of the process. The package, which has been name Access (A coal conversion economics simulation system) has been designed to be simple, flexible and user-friendly, to run on a microcomputer and to require no particular computer-programming expertise on the part of the user. The package has been used to simulate key stages of the liquid solvent extraction process for direct coal liquefaction under development by British Coal. A worked example showing the application of Access to this simulation problem is included in the main report on this contract. 16 figs., 3 tabs.

43679 (EUR–12479) **Pyrolysis and gasification.** Ferrero, G.L.; Maniatis, K.; Buekens, A.; Bridgewater, A.V. (eds.). Commission of the European Communities, Luxembourg (Luxembourg). 1989. 694p. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). Source: Elsevier Science Publishers, London (UK).

The focus of the conference was the thermochemical processing of renewable resources and solid fuels. A total of 35 papers was presented in 7 sessions with the following titles: opening session and country overviews; pre-treatment and characterization; pyrolysis, gasification and liquefaction technologies; pyrolysis case studies; gasification case studies; upgrading, clean up and utilization of products; economic, environmental and legal aspects. In addition 47 papers were presented in 3 poster sessions entitled: pre-treatment, products and other aspects; pyrolysis technology; and gasification technology. 6 papers have been abstracted separately.

43680 (EUR–12479, pp. 72-84) **Characterization of carbon containing materials with respect to pyrolysis and gasification.** Muehlen, H.-J. (Bergbau-Forschung GmbH, Essen (Germany, F.R.)); Wanzl, W.; van Heek, K.H. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

From the broad use of thermochemical conversion of coal and other solid fuels various methods have been established for their characterization with respect to pyrolysis and gasification. The experimental techniques and theoretical methods including those for reactor modeling are reviewed, taking as examples those in use at Bergbau-Forschung. Typical results achieved for coal and lignites are shown, demonstrating how the experimental devices and the theoretical background can be used to characterize other carbonaceous materials like biomass and wastes. The final aim is the design of new or the optimization of existing processes with respect to the feedstock available and the products desired. 10 refs., 9 figs., 5 tabs.

43681 (EUR–12479, pp. 246-249) **Flash-pyrolysis of Sulcis coal.** Conti, L. (Universita di Sassari, Sassari (Italy). Dipartimento di Chimica); Scano, G. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

Flash-pyrolysis of an Italian coal (Sulcis coal) has been investigated in fluidized bed pyrolyser in nitrogen or methane atmosphere and between 600 and 900°C. The maximum tar yield is obtained at 600-620°C. The pyrolysis oil can be upgraded afterwards. Experiments in methane atmosphere support a possible radical mechanism for the reaction. 5 refs., 2 figs., 4 tabs.

43682 (EUR–12479, pp. 296-303) **An investigation into the gasification of low quality coal with oxygen enriched air in a fixed bed gasifier.** Engelbrecht, A.D. (CSIR, Pretoria (South Africa). Division of Energy Technology). Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

The performance of air and steam blown gas producers deteriorates rapidly when low quality high ash coals are used as feedstock. An investigation was carried out to determine to what extent gas quality and gas output can be improved when the blast air is enriched with oxygen. Extensive testing was done on a small industrial scale gas producer plant (5GJ per hour output). Using the data obtained, a techno-economic study was done to determine the optimum level of oxygen enrichment to be used for various coal qualities. The investigation showed that enrichment of air with oxygen was economically attractive based on both capital expenditure and running costs. 4 refs., 5 figs., 1 tab.

43683 (EUR–12479, pp. 304-311) **Pressurized fluidized bed gasification of peat.** Kurkela, E. (Technical Research Centre of Finland (VTT), Espoo (Finland). Laboratory of Fuel Processing Technology); Staahlberg, P.; Moltahedi, W.; Nieminen, M. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

An experimental research project on pressurized fluidized-bed gasification of peat and wood waste was initiated at the Technical Research Centre of Finland (VTT) in 1986. This research is related to the development of gas turbine power plants based on air gasification and hot gas clean-up. The first test runs with the pressurized gasifier were carried out in summer 1988. The gasifier was operated at pressures of up to 10 bar and the maximum thermal input with peat was 400 kW. Air and steam were used as gasification agents. During 175 hours of operation 11 tons of peat were successfully gasified. The effect of operating conditions on gas composition, tar formation and fines elutriation was investigated. Carbon conversion without cyclone dust recycle was 75-85% and the calorific value of the gas (LHV) ranged 4-4.5 MJ/Nm^3. Alkali metals release in fluidized-bed gasification of peat was investigated experimentally and theoretically. Samples were taken from various points and analyzed for the alkali metal content. The results are compared with the theoretically predicted values. 8 refs., 4 figs., 4 tabs.

43684 (EUR–12479, pp. 563-567) **Pyrolysis of Greek lignites.** Lappas, A.A. (Aristotelian University of Thessaloniki, Thessaloniki (Greece)); Vasalos, I.A. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

Two different types of Greek lignites were evaluated using the fast pyrolysis process in a fluidized bed reactor. The innovation of this experimental system is that the reactor effluent is connected on line with a flame ionization detector (FID) and a thermal conductivity detector (TCD) for the continuous monitoring of total hydrocarbons and total gases respectively. The total yield distribution of the various products was obtained as a function of pyrolysis temperature and lignite particle size. Two kinetic models for coal decomposition were also tested for the determination of the appropriate kinetic parameters. From this work it can be concluded that: (1) The produced gases from the pyrolysis of Greek lignites are dominated by oxygen compounds CO_2, CO. A number of hydrocarbons are also produced (C_1-C_6). (2) The experimental results are interpreted reasonably well with the competing reaction model. 6 refs., 5 figs.

43685 (EUR–12479, pp. 608-612) **Peat ammonia plant in Oulu - synthesis gas production from peat by fluid-bed gasification.** Sipilae, K. (Technical Research Centre of Finland (VTT), Espoo (Finland). Laboratory of Fuel Processing Technology); Wilen, C.; Kurkela, E.; Moilanen, A.; Koljonen, J. Commission of the European Communities, Luxembourg (Luxembourg). 1989. (CONF-8905323–: International conference on pyrolysis and gasification, Luxembourg (Luxembourg), 23-25 May 1989). In *Pyrolysis and gasification.* Source: Elsevier Science Publishers, London (UK).

A peat ammonia factory was put into operation at the Oulu Works of Kemira Oy in summer 1988. The factory uses about 1.2 million MWh sod peat for producing 80 000 t/a ammonia for fertilizer production. The total investment in replacing the old heavy-oil based plant with a peat-based one was FIM 225 million, and it concerned peat handling, drying and gasification and gas cleanup. The plant is the only plant producing synthesis gas from peat in the world. Similar technology can also be used for biomass. Sawdust has been gasified mixed with peat. Sod peat is crushed and dried in a pressurized steam dryer, and the dry peat is then gasified in a pressurized HTW gasifier with oxygen and steam. The trial runs of the plant were started in May 1988, and ammonia production in August 1988. The longest uninterrupted operation time has so far been 31 days. In the research work carried out in cooperation between Kemira Oy and the Technical Research Centre of Finland, the main topics have been crushing and drying of raw material, feeding into a pressurized reactor, safety, reactivity and gas impurities in gasification, ash behaviour, and waste waters. Research results are reviewed in this paper. Further research will focus on peat handling and on gas impurities. A new project has been initiated on IGCC applications, where hot gas cleanup and biomass utilization in pressurized reactors are of major iterest. The work is a part of a national fuel processing research programme JALO. 9 refs., 4 figs., 1 tab.

43686 (LBL–28710) **Fundamental studies of catalytic gasification: Quarterly report, January 1, 1990–March 31, 1990.** Heinemann, H.; Somorjai, G.A. Lawrence Berkeley Lab., CA (USA). Mar 1990. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC03-76SF00098. Order Number DE90016633. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Previous work has shown that chars and coal can be gasified with steam in the presence of alkali-transition metal oxide catalysts or alkali-earth catalysts at relatively low temperatures. These studies are to be extended to the investigation of the amounts of catalysts required and whether a throw away catalyst can be used. This quarter work was concentrated on the oxidative coupling of methane over catalysts of the type discovered during coal gasification. Highlights include: discovery of a novel catalyst ($KCaNiO_x$) that will permit oxidative coupling of methane at close to 100% selectivity to C_2 hydrocarbons at 10% CH_4 conversion; the presence of water has been found important for oxidative coupling of C_4 over either $KCaNiO_x$ or $KCaO_x$ catalysts; absence of CO_x in the products from coupling greatly effects economics; high selectivity to C_2 hydrocarbons was maintained over extended periods of time; a large number of potential methane coupling catalysts were prepared; calcination conditions of the catalysts were found to be important factors; and $KCaO_x$ catalysts steam gasification of char give highest C_2 yields at the lowest CH_4/O_2 ratios feasible outside explosive limits. 2 figs., 4 tabs.

43687 (ORNL/Sub–86-55936/01) **Solid particle erosion in turbulent flows past tube banks.** Humphrey, J.A.C. (California Univ., Berkeley, CA (USA). Dept. of Mechanical Engineering). Oak Ridge National Lab., TN (USA); California Univ., Berkeley, CA (USA). Dept. of Mechanical Engineering. Feb 1990. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90015711. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Judging from the extensive literature on the subject, the phenomenon of material erosion by solid particle impact continues to challenge both practitioners and theoreticians with very complex problems. Although the importance of fluid motion to this form of wear was recognized in early works, many researchers continue to interpret and attempt to understand particle impact erosion almost exclusively in terms of the material properties involved. Little attention has been given to clarifying the influence of fluid motion, especially in the turbulent flow regime. A review of some relevant issues is presented here. It starts with an exposition of the general problem and the need for better understanding. The discussion of experimental techniques is followed by various fundamental considerations relating to the motion of solid particles conditioned by the presence of a carrier fluid, neighboring particles and a constraining solid surface. Of the experimental techniques used in erosion studies, non-intrusive optical methodologies are the most promising for measuring particle and fluid phase velocities simultaneously near a surface. Numerical models for calculating particle-laden flows and their application to predict erosion in practical engineering flow configurations are briefly discussed. Emphasis is placed throughout on uncovering areas of inadequate fundamental understanding of fluid mechanics phenomena that significantly effect erosion by solid particle impact. 221 refs., 13 figs.

43688 (ORNL/Sub–86-95900/02) **Investigation of the effects of microalloy constituents, surface treatment and oxidation conditions on the development and breakdown of protective oxide scales: Final report.** Vedula, K. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Materials Science and Engineering). Oak Ridge National Lab., TN (USA); Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Materials Science and Engineering. 16 Apr 1990. 72p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90015710. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Corrosion of materials in mixed gas environments at elevated temperatures is a problem in the fossil energy power generating industry. Mixed atmospheres containing oxygen and sulfur are particularly harmful in coal conversion systems. Considerable research on the causes, effects and prevention of different types of corrosion has been in progress over a long period of time. The thermodynamic and kinetic aspects of corrosion in mixed gas environments containing oxygen, as well as sulfur, have been studied quite extensively in recent years. Some of these studies are reported in references 1 to 16. However, a complete understanding of the basic mechanisms of degradation of oxide scales, particularly at low temperatures, is not available. Lower temperatures in the range of 500 to 700°C are of particular interest for many of the coal conversion equipments. The focus of the current program has been to obtain an understanding of the behavior of iron-based alloys in mixed oxygen and sulfur environments at these lower temperatures. The particular emphasis has been on the initial stages of development and breakdown of oxide scales in atmospheres containing high pS_2/pO_2 ratios at temperatures in the range of 500 to 700°C. Fe-25 wt % Cr, Fe-25 wt % Cr-20 wt % Ni and Fe-25 wt % Cr-6 wt % Al were the base alloys for this investigation. Of particular interest were the effects of reactive element additions Ce, Hf, La, Y through bulk alloying as well as through ion implantation and the effects of surface modification through peroxidation. 43 refs., 40 figs., 5 tabs.

43689 (PB–89-166136) **Advanced coal gasification symposium.** Flowers, A.; Spencer, D.; Tarman, P.; Holmgren, J.; Lohmann, C.; Sharman, R. Gas Research Inst., Chicago, IL (USA). 1982. 233p. (CONF-8209314–: Advanced coal gasification symposium, Beijing (China), 20-28 Sep 1982; GRI–82/7005). Source: NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA.

This trip report on the symposium contains introductory information on coal gasification in China, opening and closing speeches (In English and Chinese), and summaries of the technical sessions. 7 papers presented by the international delegation are included. These covered coal gasification - introductory overview, modular integrated coal gasification combined cycle power plants, Hygas Process development, Westinghouse Coal Gasification Process, U-Gas Process, Ruhr 100 - the further development of the Lurgi Gasifier at Dursten, and coal gasification - how efficient can it be?

43690 (PB–89-166144) **Second advanced coal gasification symposium.** Flowers, A.; Spencer, D.; Holmgren, J.; Von der Burgt, M.; Nitschke, E. Gas Research Inst., Chicago, IL (USA). 1983. 200p. (CONF-8306309–: 2. advanced coal gasification symposium, Shanghai (China), 27 Jun - 2 jul 1983; GRI–83/7005). Source: NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA.

This trip report on the symposium contains introductory information on energy science in China, the opening speeches, summaries of the technical sessions, and lists of delegates. 6 papers presented by the international delegation are included. These covered an assessment of coal gasification systems and their associated environmental control technologies, an economic comparison of coal gasification in the USA and an update of the 100MW Cool Water Coal Gasification combined cycle project, the Westinghouse Coal Gasification Process, the Bi-Gas Process, development of the Shell Gasification Process, and the Rheinbraun High-temperature Winkler Process.

43691 (PB–89-166151) **Third advanced coal gasification symposium.** Flowers, A.; Holmgren, J.; Perhac, R.; Lam, E.; Menzies, W. Gas Research Inst., Chicago, IL (USA). 1985. 247p. (CONF-8504346–: 3. advanced coal gasification symposium, Beijing (China), 30 Apr - 3 may 1985; GRI–85/7007). Source: NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA.

Included in these proceedings are introductory information on China's coal industry and atmospheric pollution, opening and closing speeches, summaries of the technical sessions and lists of delegates. The appendices contain information on coal mine design institutes in the Chinese provinces, regional coal research institutes, branches and directly subordinate research institutes of the Coal Academy of Scientific Research and central stations and substations of scientific and technological information of the Ministry of Coal Industry. 9 papers by the international delegation are also included, covering KRW gasifier, acid rain, wastes from conventional coal burning and gasification plants, Great Plains SNG Process, environmental aspects of Great Plains gasification plant, use of Dolomitic lime process for flue gas cleaning, environmental impact assessments for coal gasification plants, ash agglomerating fluidized bed coal gasification, and the Cool Water integrated coal gasification combined cycle program.

43692 (PB–89-166177) **Fifth advanced coal gasification symposium.** Flowers, A. (and others). Gas Research Inst., Chicago, IL (USA). 1987. 197p. (CONF-8709496–: 5. advanced coal gasification symposium, Taiyuan (China), 14-18 Sep 1987; GRI–87/0337). Source: NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA.

This report was prepared as an account of an international delegation to the symposium. Opening and closing speeches, summaries of the technical sessions, and lists of delegates are included. 13 papers presented by the international delegation are given. These covered recent advances in methanol and liquid fuels from coal, the Voest-Alpine process, ammonia manufacture based on the Texaco Coal Gasification Process, liquid redox sulphur recovery, Lurgi Processes, Prenflo demonstration plant, BGL slagging gasifier in integrated coal gasification combined cycle power generation, Rheinbraun HTW process, operation of a high pressure ash-agglomerating coal gasifier, entrained flow coal gasification, Kellog/KRW IGCC system, Dow Coal Gasification Process, and the Shell Coal Gasification Process.

43693 (PB–90-239922/XAB) **Coal catalyzation to simplify the conversion of coal to SNG. Final report, March 1988-May 1990.** Feldmann, H.F.; Creamer, K.S. Battelle Memorial Inst., Columbus, OH (USA). May 1990. 234p. Source: NTIS, PC A11/MF A02.

The process implications of catalyzing coal with impregnated calcium on the production of Synthetic Natural Gas (SNG) were evaluated. An Illinois No. 6 was catalyzed with calcium at various treatment conditions and then gasified in a thermal gravimetric analyzer (TGA) to determine empirical relationships relating its reactivity to treatment and gasification conditions. Catalyzed coal was also gasified in a continuous bench-scale fluid bed steam/oxygen gasifier. Results of these tests indicate catalyzation eliminates agglomeration and substantially increases gasification reactivity. In

addition, the calcium acts as a sulfur adsorbent. Process cost modeling studies indicated that the greatest economic potential for the utilization of catalyzed coal is to take advantage of the reactivity by utilizing a system for steam gasification of the coal using heat supplied by combustion of the gasified char in a separate combustor thereby eliminating the need for oxygen while maintaining production of a medium BTU gas. The results of this work are also directly applicable to gasification systems for electric power generation as well as for the production of synthesis gas for chemical production.

43694 (SAND–90-2145C) **Impacts of initial reaction chemistry on direct coal liquefaction processes.** Stohl, F.V.; Kottenstette, R.J.; Stephens, H.P. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC04-76DP00789. (CONF-9010173–1: 7. DOE-PETC/AIST-NEDO joint technical meeting, New Orleans, LA (USA), 8-12 Oct 1990). Order Number DE90015780. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The initial reactions that occur during liquefaction can have significant impacts on process yields and downstream process conditions. Reactions that result in compounds with low molecular weights and decreased boiling points are beneficial, whereas retrogressive reactions, which yield higher molecular weight compounds that are refractory to further processing, give lower yields of desired products. The objectives of this research are to determine the process conditions that give rise to retrogressive reactions during preconversion processing and to identify methods for minimizing the occurrence of these reactions. Initial studies have been performed using dibenzyl ether as a compound to model ether linkages in coal. Results show that retrogressive reactions can occur at temperatures as low as 180°C. The presence of a good hydrogenation catalyst and a hydrogen donor was found to minimize retrogressive reactions, whereas the presence of mineral matter, primarily clay minerals, and $ZnCl_2$, enhanced the reactions. 8 refs., 3 figs.

0105 Products and By-Products

Refer also to citation(s) 43658, 43668, 43690

43695 (PB–90-872656/XAB) **Coal tar technology. August 1973-May 1990 (A Bibliography from the NTIS data base). Report for August 1973-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 172p. Source: NTISPC N01/MF N01.

Supersedes PB–89-864706.

This bibliography contains citations concerning various aspects of coal tar. Topics include production from coal gasification, synthesis of chemicals from coal tar, and chemical analyses of coal tar products. Toxicology, pollution studies, and commercial uses of the product are also discussed. (This updated bibliography contains 284 citations, 13 of which are new entries to the previous edition.)

0106 Properties and Composition

Refer also to citation(s) 43652, 43676, 43695, 43705, 43716, 43717, 43763, 44876

43696 (DOE/PC/90534–15) **Supercritical fluid chromatography/supersonic jet spectroscopy: Final report, September 15, 1986–December 31, 1989.** Goates, S.R.; Lee, M.L. Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry. [1989]. 37p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90534. Order Number DE90015220. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Supersonic jet spectroscopy (SJS) was successfully coupled to supercritical fluid chromatography (SFC) and developed as high resolution technique for the analysis of complex samples. Direct supersonic expansion of the supercritical fluid was shown to be compatible with micro-bore and larger column SFC; high pressure sheath-flow expansions allowed capillary SFC to be performed with SJS. Selective, sensitive detection was demonstrated with both techniques for a coal tar sample. Design and characterization of nozzle performance was an important effort in the development of the SFC/SJS technique, including study of the direct expansion process, modification of the sheath-flow approach to make it applicable to supercritical fluid experiments, testing of several variations of pulsed nozzles, and investigation of back-pressure regulation of flow in capillary SFC to improve efficiency and resolution. Finally, improvements to signal detection and alternative detection schemes were investigated in efforts to enhance sensitivity and information content of the measurement. Perylene and benzo[a]pyrene were selectively detected in a coal tar samples at detection limits of 0.5 ng and 40 ng, respectively. Back-pressure regulation of eluent flow using the sheath-flow nozzle was investigated as a means of control in capillary SFC. Pre-restrictor detection was employed in the evaluation of the effect of regulated flow on chromatographic separations. Chromatographic resolution was improved when a constant linear velocity was maintained. 49 refs., 11 figs.

43697 (NZERDC–155) **Assessment of the industrial potential of west coast coal.** New Zealand Energy Research and Development Committee, Auckland (New Zealand). Mar 1988. 122p. Source: New Zealand Energy Research and Development Committee, Wellington (New Zealand).

Contains a list of references for volume 1 of the report, a discussion of coal quality characteristics required in conventional coal combustion and tables of coal quality data for coal from the Buller, Refton and Greymouth coalfields.

43698 (PB–90-231275/XAB) **Development of infrared methods for characterization of inorganic sulfur species related to injection desulfurization processes. Final report, December 1985-June 1988.** Thompson, M.M.; Palmer, R.A. Duke Univ., Durham, NC (USA). Dept. of Chemistry. May 1990. 141p. Source: NTIS, PC A07/MF A01.

Current methods designed to control and reduce the amount of sulfur dioxide emitted into the atmosphere from coal-fired power plants and factories rely upon the reaction between SO_2 and alkaline earth compounds and are called flue gas desulfurization (FGD) processes. Of these methods, dry desulfurization processes, using fine particulate limestone, have emerged as the preferred technology for future SO_2 emission control. The development of a reliable in situ spectroscopic technique for studying heterogeneous reactions, such as those occurring in FGD systems, is the key to understanding the surface mechanisms which control these reactions. The report covers the development and application of Fourier transform infrared spectrometry with photacoustic and diffuse reflectance detection for this purpose. The specific reactions chosen for study are those of SO_2 with CaO, $CaCO_3$ and $Ca(OH)_2$. The project evaluates the feasibility of using these infrared spectroscopic techniques to monitor reactions between limestone and related materials with SO_2 at various temperatures so as to aid in obtaining a clear understanding of the chemical mechanisms by which SO_2 is captured.

43699 (PB–90-235771/XAB) **Chemical tests for nutrient and trace-element availability in coal-cleaning wastes: Development of methods based on routine soil tests. Final report, 29 September 1980-28 February 1982.** Gamboa Lewis, B.A. Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering. 28 Feb 1982. 130p. Source: NTIS, PC A07/MF A01.

The objective of the research was to determine whether tests that have been useful for agricultural soils can be just as useful for evaluating the chemical quality of coal-cleaning refuse as a medium for plant growth. If not, then a second objective was to determine what modifications should be made, either in the test or its interpretation, for application to the wastes. It was expected that such information would also be useful for other types of wastes. The approach used to achieve these objectives was a combination of greenhouse and laboratory procedures, where coal wastes were compared to an Illinois agricultural soil in terms of behavior in routine soil tests. The tests selected were those considered here to be the most important for evaluating a material as a plant growth medium, and included both physical and chemical methods. As was expected, some changes to the proposed work were made, as results accumulated.

43700 Computer modeling of bituminous coal structure. Carlson, G.A. (Sandia National Laboratories, Albuquerque, NM (USA)). *Energeia (Lexington, Kentucky) (USA)*, 1(3): 1-2 (1990).

The efficiency of direct liquefaction is governed by coal reactivity, which in turn is related to its molecular structure. At Sandia National Laboratories, computer modeling techniques are used to study the structure of bituminous coal, based on both molecular and macromolecular structural concepts. Visualization of structures in three dimensions, coupled with force field calculations of minimum energy conformations, gives new insights into the important properties driving coal structure. 2 figs.

43701 **Chemistry and structure of coals: hydrogen bonding structures evaluated by diffuse reflectance infrared spectroscopy.** Fuller, E.L. Jr. (Oak Ridge National Laboratory, Oak Ridge, TN (USA)); Smyrl, N.R. *Applied Spectroscopy (USA)*, 44(3): 451-461 (Mar-Apr 1990).

Coal formation is a dynamic process that transforms plant residues into a rigid matrix of carbonaceous materials over the eons at somewhat elevated temperatures and pressures. Diffuse reflectance infrared spectroscopy (DRIS) is very informative in monitoring the maturation process by studying representative samples of coal, lignite and peat of given geologic maturity. Qualitative examination of the spectra is a facile and reliable means of ranking the coal. Further analyses of the DRIS data reveal that hydrogen bonding is a major force binding coals together. Five distinct types of hydrogen bonding exist, corresponding to the number of electric donor oxygen (proton acceptor) atoms involved. Rigidification of the cellulosic structures develops stronger fields, giving rise to a generally stronger set of hydrogen bonds. The successively stronger hydrogen bonds are noted to give rise to lower frequencies of resonance and widths of bands, and the stronger dipoles have greater extinction coefficients. Infrared spectroscopy is the most informative means of exploring the intricacies of the hydrogen bonds in coals. This preliminary work shows the merits of the DRIS technique, in that the studies are performed with neat samples (free from chemical and physical artifacts associated with support media and dilution agents). 27 refs., 16 figs., 3 tabs.

0108 Waste Management

Refer also to citation(s) 43676, 43691, 43698, 43699, 43714, 43758, 44208, 44209, 45277

43702 (EUR–11662-EN) **The macroeconomic impacts of the EC large combustion plants directive proposal.** Economic aspects of controlling acid rain in Europe, Volume I. Klaassen, G.; Kee, P.; Nentjes, A.; Hafkamp, W.; Olsthoorn, A.A. Vrije Univ., Amsterdam (Netherlands). Inst. voor Milieuvraagstukken. 1988. 126p. Source: Commission of the European Communities, Luxembourg.

This study assesses the costs and ensuing macroeconomic impacts of the proposed Directive on large combustion plants for each EC country including proposals made up to the end of 1986. The draft directive pertaining to SO_2 and NO_x emissions stipulates that:(1) new plants larger than 50MW thermal capacity must comply with emission standards which are related to the size of the plant; and(2) EC member states are to reduce total emissions from large combustion plants by the end of 1995. The study focusses on macroeconomic indicators such as gross domestic product or GDP (value of total production within a country), employment, private consumption, current balance of payments account, consumer prices and the balance of government budget (revenue less expenditures). In addition to interactions within the separate national economies, analysis of the interdependancies between them is examined by the use of an international model, called INTERLINK.

43703 (PB–90-229899/XAB) **Long-term removal and retention of iron and manganese from acidic mine drainage by wetlands. Volume 1. Methods, results, and appendices. Final report, July 1987-January 1990.** Brooks, R.P.; Unz, R.F.; Davis, L.K.; Tarutis, W.J.; Yanchunas, J. Pennsylvania State Univ., University Park, PA (USA). Environmental Resources Research Inst. Jan 1990. 147p. Source: NTIS, PC A07/MF A01.

See also Volume 2, PB–90-229907.

A promising low-technology solution for treating acidic mine drainage (AMD) emanating from coal mined lands involves the use of constructed wetlands. The research was directed at addressing questions about retention mechanisms for the long-term storage of iron and manganese in constructed wetlands dominated by broad-leaved cattails (Typha latifolia). Three sites in central Pennsylvania spanning the range of water chemistry parameters found in AMD were investigated. When the AMD was circumneutral, and metal loadings were low, 79% of the iron, and 48% of the manganese were retained on average. In the highly acidic site (pH approx. = 3), < 10% of the metal loadings were retained. The primary retention mechanism appears to be the formation of metal oxides in the aerobic zones of the sediments. Although most microbial isolates extracted from sediment cores originated in the aerobic portions of the sediments, there was no evidence that they were transforming metals. When AMD is circumneutral and metal loadings are low, constructed wetlands can be an effective approach to treating mine drainage. At sites with highly acidic waters and high metal loadings, the use of constructed wetlands to treat AMD may be ineffectual, and should be implemented with caution.

43704 (PB–90-229907/XAB) **Long-term removal and retention of iron and manganese from acidic mine drainage by wetlands. Volume 2. Tarutis thesis. Final report, July 1987-January 1990.** Brooks, R.P.; Unz, R.F.; Davis, L.K.; Tarutis, W.J.; Yanchunas, J. Pennsylvania State Univ., University Park, PA (USA). Environmental Resources Research Inst. Jan 1990. 143p. Source: NTIS, PC A07/MF A01.

See also Volume 1, PB–90-229899.

The behavior of sedimentary iron and manganese in a volunteer wetland receiving mine drainage on a reclaimed coal surface mine in Pennsylvania was characterized to determine if these metals can be retained in the sediments. Five metal fractions sensitive to changes in environmental conditions were examined. The potential for the association of iron and manganese with organic carbon and sulfur was studied to evaluate diagenetic changes important to metal cycling in wetland sedimentary environments. The aerobic zone was characterized by an abundance of iron and manganese oxides, organic carbon, and sulfur in the sediment, and virtually no dissolved iron and manganese in the interstitial water. The anaerobic zone was characterized by relatively low levels of iron and manganese oxides and a concomitant increase of dissolved iron and manganese in the interstitial water. The low concentration of metal sulfides and the high carbon/sulfur ratios observed suggest that sulfate reduction was a relatively unimportant process for metal removal. In the wetland studied, the aerobic zone was more important in metal retention than the anaerobic zone based on the results of multivariate analysis.

43705 (PB–90-239658/XAB) **Strength and consolidation characteristics of coal refuse for design and construction of disposal facilities: Applications of research findings. Final report.** Huang, Y.H. Kentucky Univ., Lexington, KY (USA). Dept. of Civil Engineering. Aug 1987. 83p. Source: NTIS, PC A05/MF A01.

The use of coal refuse properties for the short-term stability analysis of disposal facilities is illustrated in the report. Three types of disposal facilities are considered: waste embankments constructed of combined or fine refuse, refuse dams constructed by upstream method, and sandwich construction by placing coarse and fine refuse in alternate layers. Detailed procedures are presented to determine the factor of safety at the end of construction using the REAME computer program developed at the University of Kentucky. The results of analysis show that limiting the maximum moisture content of combined or fine refuse in waste embankments and keeping the construction of refuse dams at a slower pace are very important for short-term stability. Due to the granular nature of coarse and fine refuse, the use of sandwich construction appears to be an efficient and economical disposal method. To compare the properties of coal refuse from the Western Coal Field with those from the Eastern Coal Field reported previously, test results on combined and fine refuse taken from two sites in Colorado are presented.

0109 Environmental Aspects

Refer also to citation(s) 43652, 43691, 43695, 43719, 43752, 43753, 44210, 45287, 45294, 45295, 45298, 45301, 45303, 45339, 45489, 45493, 45625

43706 (DOE/SR/15170–3) **Kinetics and mechanisms of the release of trace inorganic contaminants to ground water from coal ash basins on the Savannah River Site: Final report.** Sandhu, S.S. Claflin Coll., Orangeburg, SC (USA). 31 Jul 1990. 60p. Sponsored by U.S. DOE Defense Programs. DOE Contract FG09-86SR15170. Order Number DE90015766. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The study was undertaken to evaluate the field effectiveness of technology applied for the disposal of ash generated by coal-fired power plant located at the Savannah River Site. The study, further, undertook to develop an understanding of the potential of release and field mobilization pattern of toxic trace elements to groundwater from impounded ash of varying age. Sediment cores, collected from ash basins of varying age, were sectioned and analyzed to collect information for elucidating the modes of mobilization and attenuation of several major and minor nutrients. Also a set of six intact ash columns was removed at a time, from the ash basins and leached with detonized H_2O, HNO_3 (pH_3), Ca $(OH)_2$ (pH^8), 0.04M NH_2OH.H Cl (pH^3) and 3.0 percent H_2O_2 (pH^3), to ascertian the extent of leaching ability of Ni, Cd, Cr and As under varying pH and redox conditions which may prevail in the field. The columns were capped after initial leaching, and stored in the laboratory for five weeks. Then each column was leached again with the same regent. Lysimeters were installed at the old and active coal ash disposal basins for monitoring the quality of groundwater during the project period. 48 refs., 17 figs., 15 tabs.

43707 (GAO/RCED–89-65) **Inland oil spills: Stronger regulation and enforcement needed to avoid future incidents.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Feb 1989. 34p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that the Clean Water Act prohibits the discharge of oil into navigable waters and requires the Environmental Protection Agency to regulate the oil industry to prevent oil spills and conduct research on the cleanup of spills. EPA's Oil Pollution Prevention regulations recommend that tanks be constructed of appropriate materials and be tested periodically for integrity, and that tank operators take precautions to contain spilled oil.

43708 (GAO/RCED–89-74) **Surface mining: Interior's response to abandoned mine emergencies.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Feb 1989. 16p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

The Department of the Interior's Office of Surface Mining Reclamation and Enforcement has been asked to provide a report describing its handling of requests for emergency reclamation of abandoned mine land sites. This report found it to be incomplete and inaccurate. It did not contain all emergency complaints received by OSMRE during 1983 through 1987 and double counted others. OSMRE inspectors visit mine sites within 48 hours after receipt of a complaint about 64 percent of the time. However, it took much longer for OSMRE to complete its investigation and decide whether an emergency existed and, if so, to award a construction contract. Currently, sufficient information is not available to effectively monitor the emergency program activities. Adequate documentation should be available to track the compliant through the review process and to verify that the criteria for emergency status approval have been met.

43709 (GAO/RCED–89-194) **Surface mining: Inadequate internal controls cause procurement problems in West Virginia.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 23p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that because of inadequate internal controls, West Virginia does not always comply with federal procurement standards when it contracts for abandoned mine site reclamation. West Virginia's procurement process is largely informal and is not controlled by written policies and procedures. As a result, a number of questionable procurement practices occurred. OSMRE, the responsible federal oversight agency, failed to identify either the internal control problems or the questionable procurement practices during its annual state oversight reviews. State officials agree that procurement problems exist and that written policies and procedures and other internal controls need to be developed to ensure compliance with federal standards. The state has already acted to correct some problems, and more actions are forthcoming. OSMRE has established a task force to review West Virginia's procurement process and internal controls and to work with the state to ensure compliance with federal procurement standards.

43710 (PB–90-225673/XAB) **Benthic macroinvertebrates of low-order streams of coal surface-mining areas of the Cumberland Plateau, Kentucky, Tennessee, and Alabama. Volume 1. Final report.** Gore, J.A.; Hughes, J.D.; Swartley, W.A. Tennessee Technological Univ., Cookeville, TN (USA). Tennessee Cooperative Fishery Research Unit. 31 May 1990. 483p. Source: NTIS, PC A21/MF A03.

Although a few studies on impacts of surface mining in the Cumberland Plateau of Kentucky, Tennessee, and Alabama have been performed, all workers agreed that their site specific examinations may not be applicable to the entire region. The study was initiated to provide a wide range of baseline information on the benthic fauna of streams of the Cumberland Plateau. When compared to available water quality data on these streams, there exists the potential to describe a general model of impacts and potential mitigating strategies for future sites of impact by coal surface mining.

43711 (PB–90-225681/XAB) **Alluvial valley floor guidelines, 1990. Final report.** Office of Surface Mining Reclamation and Enforcement, Washington, DC (USA). 31 May 1990. 57p. (OSM–002). Source: NTIS, PC A04/MF A01.

Portions of this document are not fully legible.

The procedures outlined in Part I of the Guidelines are intended to be those which can be accomplished in a short period of time. It describes how land use data may be used to investigate the potential for flood irrigation on lands within the region. Part II is a representative of the procedures necessary to clarify the status of areas identified as possible alluvial valley floors. Part III outlines the extent of studies that could be used to define the essential hydrologic functions of alluvial valley floors. The procedures are all field-oriented and the extent of the studies depends on the complexity of the alluvial valley floor (principally hydrologic complexity).

43712 (PB–90-233149/XAB) **Characterization of leachate from abandoned coal refuse. Final report.** Essington, M.E.; Hill, S.L.; Jackson, L.P.; Koesters, D.B.; Mason, G.M. Western Research Inst., Laramie, WY (USA). 1987. 322p. Source: NTIS, PC A14/MF A02.

The principle objective of the project was to identify and characterize all waste substances leaching from abandoned coal refuse. Waste substances are defined as those elements or compounds listed or classified as hazardous by the Resource Conservation and Recovery Act of 1976 (RCRA). A detailed examination was made of all regulations effecting hazardous waste disposal and a list of those organic and inorganic parameters present or possibly present in coal were identified. The potential environmental impact of each of the 77 Appendix VIII constituents which may be present in coal refuse or its leachate is discussed. The major sources of health effects and environmental impact data were consulted and the findings were incorporated into a summary table. Detailed information on each of the elements or compounds is contained in an appendix.

43713 (PB–90-235086/XAB) **Summary of the 1988 EPA National Performance Audit Program on Source Measurements. Final report.** Streib, E.W. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Jul 1990. 33p. (EPA–600/3-90/050). Source: NTIS, PC A03/MF A01.

In 1988, the Quality Assurance Division conducted the National Audits for Stationary Source Test Methods. The audit materials consisted of: a disposable gas cylinder for Method 3 (Orsat analyzer), a calibrated orifice for Method 5 (DGM only), five simulated liquid samples each for Method 6 (SO2) and Method 7 (NOx), and two coal samples for Method 19. Participating laboratories sent their data to the Source Branch and in return received a written report

comparing their results to EPA's. In the Method 3 audit, each parameter had only one concentration. The mean for CO_2 was 4.2% from the expected (EPA) value. The mean for O_2 was 0.4%. In the Method 5 audit, the mean value for all participants differed by 3.1% from the expected value. For the Method 6 audit, the average mean differed by 3.9% from the expected value, and in the Method 7 audit, the average mean differed by 23.7%. In the two coal audits, the parameters measured were sulfur, moisture, ash, and Btu content. On the average, for the sulfur analysis, 91% of the participants measured within 10% of the expected value; for Btu, 97% of the participants measured within 10% of the expected value.

43714 Third round of Clean Coal Technology projects announced. Smock, R.W. *Power Engineering (USA)*, 94(3): 8-10 (Mar 1990).

This paper describes the new projects in the Clean Coal Technology (CCT) program of the United States government. The focus of the program is on reducing emissions from combustion of coal in new installations and through retrofits to existing facilities. They projects are listed and summarized.

43715 Geochemical factors controlling the mobilization of inorganic constituents from fossil fuel combustion residues: 1. Review of the major elements. Mattigod, S.V. (Pacific Northwest Laboratories, Richland, WA (USA). Environmental Science Dept.); Rai, D.; Eary, L.E.; Ainsworth, C.C. *Journal of Environmental Quality (USA)*, 19(2): 188-201 (Apr-Jun 1990).

Available data on physical, chemical, mineralogical, extract, and leachate characteristics of fossil fuel combustion (FFC) wastes, such as fly ash, bottom ash, flue gas desulfurization (FGD) sludge and oil ash, have been compiled and reviewed, and a comprehensive approach to understanding how major elements are mobilized from fossil fuel wastes is described. Many of the physical properties of fly ashes overlap those of bottom ashes; similar data for FGD sludge and oil ashes are sparse. One taxonomic and three utilitarian classification schemes have been proposed for fly ashes. However, no taxonomic system is applicable to all FFC wastes. The ranges of concentrations of Al, Ca, and Fe found in these wastes were within the ranges of their concentrations in soils. Concentrations of K, Na, Mg, and S in some FFC-+astes may exceed their highest concentrations in soils. The matrix of fly ashes consists principally of quartz, glass, and mullite. As minor components in fly ashes, anhydrite, lime, periclase, hematite, and magnetite are reported frequently. A minor fraction of many of the major elements may also be present in a glassy phase. The principal compounds in FGD sludges are sulfites, sulfates, carbonates, and hydroxide of Ca. The oil ashes contain mainly sulfates and oxides of Al, Na, Fe, and Mg. Water extracts of FFC wastes contain significant fractions of Ca, Mg, K, and Na, a fact that confirms the presence of these elements in highly soluble forms. Leaching studies conducted using fly ash columns have shown that initial leachates contain high concentrations of Ca, Na, K, and S and that as leaching continues these concentrations decline and reach steady states. Usually only negligible fractions of Si, Al, Fe, and Mg are leached from fly ash columns.

0110 Reserves, Geology, and Exploration

Refer also to citation(s) 43701, 43897

43716 (LA–11211-Vol.2) **Changuinola peat deposit of northwest Panama: Volume 2: Resource assessment.** Cohen, A.D.; Raymond, R. Jr.; Ramirez, A.; Morales, Z.; Ponce, F. Los Alamos National Lab., NM (USA). Jul 1990. 179p. (In English, Spanish). Sponsored by U.S. Agency for International Development. DOE Contract W-7405-ENG-36. Order Number DE90015022. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Results are given for a series of studies designed to assess the economic potential of a newly discovered peat deposit located near Changuinola in northwestern Panama. We have focused on using the peat to fuel an electrical power plant for this town, which currently uses high-cost imported oil to generate its electrical power. Analyses of the chemical and physical properties of over 250 samples reveal that the deposit is large (more than 82 km^2 and averaging 8 m thick), high in purity (greater than 96% organic and less than 0.2% sulfur), and high in heating value (averaging 10,000 Btu/lb dry). For all parameters measured, this peat matches or exceeds in quality peats already fueling power plants in other parts of the world. 22 refs., 31 figs., 8 tabs.

43717 (NZERDC–155) **Assessment of the industrial potential of west coast coal.** New Zealand Energy Research and Development Committee, Auckland (New Zealand). Mar 1988. 211p. Source: New Zealand Energy Research and Development Committee, Wellington (New Zealand).

The main objectives of the study reported here were the development of a database of geological and coal quality data; an initial end use assessment of west coast coals; geological evaluation of the coalfields; mining appraisal; preliminary use assessment and the identification of data deficiencies. The results are reported in two parts. Part I reviews the geology and mineability of west coast coals, while part II reviews new and conventional coal utilisation processes and their coal quality requirements, and assesses the potential utilisation of selected west coast coals.

43718 (PB–90-235698/XAB) **Evaluation of coal resources in the eastern part of the Fort Peck Indian Reservation, Montana.** Biewick, L.R.H.; Hardie, J.K.; Williamson, C.; Arndt, H.H. Geological Survey, Alexandria, VA (USA). 1990. 145p. (USGS-BULL–1869). Source: NTIS, PC A07/MF A01.

Also available from Supt. of Docs.

As part of a program to assess mineral resources in selected Indian lands, the coal resource investigation in the Fort Peck Indian Reservation was conducted by the U.S. Geological Survey in cooperation with the Bureau of Indian Affairs. The report represents the part of the study that deals with the evaluation of lignitic coal resources in the eastern part of the Fort Peck Indian Reservation. The coal resources were calculated using computerized techniques in a 1,000-sq mi area underlain by the coal-bearing Paleocene Fort Union Formation. For the study the objectives of the resource calculation were to estimate the coal resources of 15 potentially recoverable coal beds in the Fort Union Formation within the limitations of the available data. The coal resource values presented in the paper were calculated using NCRDS (National Coal Resources Data System).

43719 (PB–90-235839/XAB) **Data from test drilling to trace movement of ground water in coal-bearing rocks near Fishtrap Lake in Pike County, Kentucky. Open file report (Final).** Davis, R.W. Geological Survey, Louisville, KY (USA). Water Resources Div. 1986. 69p. (USGS-OFR–86-535). Source: NTIS, PC A04/MF A01.

In the summer of 1985 the U.S. Geological Survey, in cooperation with the U.S. Office of Surface Mining and assisted by personnel of the Kentucky Geological Survey, conducted a study at a site in the Eastern Kentucky coal field to trace the movement of ground water in a typical coal-bearing sequence of Pennsylvanian age rocks. Eight test holes were drilled at different altitudes on a hill slope and 1,272 feet of NX(3 in. outside diameter) core was collected. Water was injected at 58 fractured horizons, selected by examination of the cores, to test the zones of greatest permeability caused by stress-relief fracturing. Rhodamine WT dye was injected in a hilltop well in October 1985, and concentrations of dye in the observation wells at lower altitudes were measured five times, ending in March 1986. The report contains the data that were collected during the study.

0120 Mining

Refer also to citation(s) 43717, 43765, 43766, 43767, 43771, 43778, 43779, 43858, 43859, 43861, 43862

43720 (DOE/FE/00016–T163) **Evaluate fundamental approaches to longwall dust control: Subprogram A, Passive barriers/spray air movers for dust control: Final report.** Kelly, J.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 83p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Contract J0318097. Order Number DE90015511. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

One method to control shearer-generated dust on longwall faces is to confine the dust cloud to the face area and keep it away from

face personnel as it travels downstream over the shearer body and beyond. Passive barriers can help this process by partitioning the airflow around the shearer into a clean split and a contaminated split. In addition, water sprays used as air movers (such as the Shearer Clearer developed on another USBM contract) aid the air partitioning process. A variety of passive barrier designs were developed and evaluated in the laboratory, tested in conjunction with the Shearer Clearer. The results showed that a headgate "splitter arm" to begin the airsplitting process is a vital part of a passive barrier system, whether or not a spray air moving system is also used on the shearer. A simple gob-side passive barrier along the edge of the shearer was also shown to help partition the airflow. Underground evaluations were conducted on a combination passive barrier/spray air moving system. The results confirmed the importance of the headgate splitter arm and showed that a gob-side barrier was very effective when used on shearers with ineffective external spray systems. The gob-side barrier was unnecessary, however, on shearers equipped with effective external air moving systems such as the Shearer Clearer. 32 figs., 14 tabs.

43721 (DOE/FE/00016–T164) **Evaluate fundamental approaches to longwall dust control: Subprogram C, Stageloader dust control: Final report.** Kelly, J.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 79p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Order Number DE90015510. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The contamination of intake air is a significant dust control problem, often overlooked on many longwall faces, that can add to the full shift dust exposure of all face personnel. Several sources can contribute to intake air contamination; however, the stageloader (particularly with a crusher) is the single largest source. The objective of this subprogram was to design and evaluate a stageloader dust control system. This was accomplished through a manufacturer's survey to document existing dust controls and determine design parameters for the new systems, laboratory investigations of potential system components, and three underground evaluations of different prototype ideas. Ultimately a series of simple, practical and mineworthy recommendation evolved for optimized stageloader dust control. These included enclosing the entire stageloader with brattice or conveyor belting and installing three auxiliary spraybars at strategic locations along the enclosed stageloader. A field test of these techniques reduced dust levels by 80 percent in the headgate and by 45 percent along the face. 27 figs., 8 tabs.

43722 (DOE/FE/00016–T165) **Evaluate fundamental approaches to longwall dust control: Subprogram D, Longwall automation technology: Final report.** Ludlow, J.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 30p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Order Number DE90015509. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of automated equipment on longwall faces can offer significant benefits by the dust exposures of face personnel can be reduced by removing them from areas of high dust concentrations. While the advantages are clear, and sufficiently mature, and developments have been commercially available, the application of automated systems on US longwalls has met with limited success. The objective of this subprogram was to determine the engineering and economic restraints on the implementation and acceptance of longwall automation technology and to study the potential dust control benefits offered by the technology. Two of the more highly developed automation techniques were chosen for detailed investigation: automated shield advance and shearer remote control. This report discusses the manufacturer surveys, mining company surveys and underground evaluations conducted as part of this effort. Specific conclusions and recommendations are offered regarding the use of the techniques. 4 figs., 5 tabs.

43723 (DOE/FE/00016–T166) **Evaluate fundamental approaches to longwall dust control: Subprogram B, Practical aspects of deep cutting: Final report.** Ludlow, J.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 59p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Order Number DE90015508. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Deep/slow cutting is one of the few changes that a longwall operator can make that will simultaneously reduce respirable dust, increase production and decrease power consumption. Though extensively employed in other countries, the technique has not seen widespread use in the United States. The objective of this research effort was to promote the use of deep/slow cutting by examination of the real and perceived constraints to its application. This report discusses the theoretical and experimental background of cutting with high pick penetration, the benefits to be obtained in terms of reduced dust make and specific energy consumption and the practical imparts of deeper cutting in terms of shearer performance and coal loading. Included in the report are literature references, results of surveys of equipment manufacturers and US longwall operations, results of laboratory and underground testing of deep/slow cutting and specific conclusions and recommendations for use of the technique. 9 figs. 1 tab.

43724 (DOE/FE/00016–T171) **Evaluate fundamental approaches to longwall dust control: Subprogram I, Mining practices: Final report.** Kelley, J; Ruggieri, S.; Babbitt, C.; Wirch, S.; Rajan, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 138p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Contract J0318097. Order Number DE90015503. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Mine operators have long known that by changing certain mining practices they can reduce personnel dust exposures. The objective of this subprogram was to identify mining practices which inherently reduce personnel exposures. This was achieved through several tasks: (a) Modeling mining cycles to quantify reductions through altered practices; one key result showed the benefits of homotropal ventilation to reduce intake contamination. (b) An underground evaluation of homotropal ventilation, which revealed that intake contamination from the stageloader and crusher can be reduced by 60 to 70 percent. (c) A feasibility study of asymmetrical drums, showing that over 60 percent less cutting can be performed upstream of shearer operators during tail to head cutting. (d) Laboratory studies of the headgate cutout, showing that exposures during the cutout can be reduced by over 90 percent using special water spray and ventilation curtain techniques. (e) Underground studies of downwind dust from cutting and shield movement, showing how to best position personnel to reduce exposures from these sources. The subprogram effort culminated in extensive technology transfer through two expert system computer programs, DUSTPRO and DRUMPRO. 18 figs., 26 tabs.

43725 (DOE/FE/00016–T172) **Evaluate fundamental approaches to longwall dust control: Subprogram F, Reversed drum rotation: Final report.** Ludlow, J.; Kelly, J.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 46p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Contract J0318097. Order Number DE90015502. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In longwall mining, a significant portion of the shearer operator's dust exposure is caused by dust generated during loading. With the conventional direction of shearer drum rotation, loading efficiency is usually poor due to obstructions caused by the ranging arms and the cowl support arms. By reversing the normal direction of rotation, however, the arms no longer provide an obstruction. This results in improved loading efficiency and reduced dust generation. This report describes the reversed drum rotation concept and presents the results of a field survey and underground evaluation conducted to prove its feasibility and to measure its dust control benefits. Through this effort, the technique was shown to be feasible from both a mining and mechanical standpoint. During the underground test, it reduced dust levels near the shearer operator's positions by about 85%. 20 figs., 4 tabs.

43726 (DOE/FE/00016–T173) **Evaluate fundamental approaches to longwall dust control: Subprogram E, Longwall application of ventilation curtains: Final report.** Babbitt, C.; Ruggieri, S. Foster-Miller, Inc., Waltham, MA (USA). May 1990. 52p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI01-81FE00016. Contract J0318097. Order Number DE90015501. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

There are a number of applications on longwall faces where Brattice curtains they can improve face ventilation and dust control

in coal mines. This report describes the laboratory development and/or field evaluation of several longwall ventilation curtains, including: wing curtains: The headgate "cut-out" provides a source of extreme dust concentrations for shearer operators. A wing curtain in the headgate, which shields the headgate drum from the ventilation airstream as the drum cuts out, can reduce the operator's dust exposures during the cutout by 50 to 60%; Gob curtains: a significant amount of ventilating air can be lost to the gob in the headgate area. A gob curtain between the first shield and the chain pillar rib can block much of the leakage and increase the volume of air supplied to the face by approximately 10%; walkway curtains: curtains in the walkway, perpendicular to the airflow, were evaluated for their potential to reduce the migration of dusty face air into the walkway. Unfortunately they proved ineffective; and Extended spillplate: a vertical extension to the existing spillplate was evaluated for its potential to partition the clean and contaminated airflow. Unfortunately, only a full-height spillplate (impractical for actual application), showed appreciable reductions in walkway dust levels. 30 figs., 3 tabs.

43727 (DOE/PC/90958–T12) **Studies of dense phase cohesive coal transport in plugs: Final technical report, September 1986–May 1990.** Klinzing, G.E. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. [1990]. 253p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90958. Order Number DE90015668. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

Pulverized coals were conveyed by plug flow mode in horizontal pipes and around 90 degree smooth bends. The bends were inclined at 0, 45, and 90 degree with respect to the horizontal. The methods to transport fine cohesive powders in plug flow mode, flow patterns of the solids being transported, and pressure loss behaviors were studied. A probe has been developed to measure the plug length, plug velocity, and plug shape in opaque pipeline based on a light sensing principle whether the plug blocked or unblocked the probe. A video camera (25 frames/sec) was also used at the viewing section to validate the prove signal. The data shows that the solids are conveyed in a discrete plug or a dense phase mode depending on the plug length, gas velocity, and pipe length. 21 refs., 42 figs., 16 tabs.

43728 (EUR–12101) **Modern management in the coal-mines.** Kindermann, F.W. (ed.). Commission of the European Communities, Brussels (Belgium). 1989. 365p. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). Source: Verlag Glueckauf, Essen (Germany, F.R.).

A total of 20 technical papers were presented at the symposium at sessions entitled: remote monitoring and control; management information systems - colliery; and management information systems - planning and reliability. This volume contains the papers and in addition, the introductory speeches given at the beginning of the conference and at the beginning of each session, the conclusions and closing address, and the round table discussions at the end of each session. The technical papers have been abstracted separately.

43729 (EUR–12101, pp. 11-23) **Information technology in a modern mine.** Shelton, M.S. (British Coal Corporation, Doncaster (UK). Information Technology Dept.). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

In October 1986, British Coal established the Information Technology Department to provide the strategic, development and operations I.T. service to the industry. The trend in concentrating coal output from fewer faces is continuing, giving emphasis to the reliability of equipment and mining systems. The British Coal Corporation has a stated objective of breaking even by 1989-90 and thereafter becoming self financing. Monitoring and control of equipment and systems, both above and below ground is established in most mines. However, accurate and well presented information relating to those systems is now recognised as of value in assisting management to improve utilisation of equipment and output from existing faces. During the past 20 years Commercial Information Systems have been developed to serve the functional departments of the Industry dealing with finance and payment of wages, purchase and storing of equipment and information relative to manpower. It is the policy of British Coal and Information Technology Department to place more emphasis on colliery operations at modern mines. The work programme will provide colliery management with information relating to: coalface operations and developments; plant management; manpower information; and pit proceeds and costs. This information will be analysed and presented to assist in problem identification and solution. The organisation of management at pit level has been considered in order to make most effective use of the information system. Information technology in a modern mine is seen as a key enabling technique now available to assist in the improvement of productivity and viability of coal mining in Britain. 1 ref., 5 figs.

43730 (EUR–12101, pp. 24-33) **Strategy for the introduction of microelectronics in coal mines.** Rauhaut, F.J. (Bergbau AG Niederrhein, Duisburg (Germany, F.R.)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The technical development of the coal mining industry is characterised by rapid introduction of microelectronics. Strategic considerations are required for correct control of this process. The considerations of this task in West Germany are described. A picture of the partially automated colliery of the nineties first evolved from consultations with experts. After comprehensive investigations a decentralised hierarchical network with bus systems was then specified as structure of the future integrated control and monitoring system for the colliery. To enable all makes to be used including those with a different technical standard, a standardised interface to augment the MAP interface for the factory of the future is being developed. This work has now reached an advanced stage and is also of interest for the other coal-producing countries in the European Community. It is planned to standardise the safety requirements for underground operation. The development of sensors for rough underground operating conditions is highly important. The underground network is linked to the information systems of the mining companies currently being rapidly extended. They are expected to bring about large increases in productivity. Improved planning systems are at an advanced stage of development. The new technical age also requires further development of organisation and management in the collieries. The development of microelectronics can be accelerated by even closer technical cooperation in the European Community. 1 fig.

43731 (EUR–12101, pp. 39-55) **Control and monitoring of coal winning districts by computer-based control centres: experiences and future developments.** Ostermann, W. (Bergwerk Friedrich Heinrich (Germany, F.R.)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The district control centre is the third level within the structure of the interlinked system of process control engineering and planning and information system. It combines local control of the system components, and coordinates the process stations, in which partial processes already take place autonomously. Coal-winning operations on the face and in roadways can be controlled and anomalous operating conditions at the monitored equipment detected at an early stage with the aid of the district control centre. In this way the colliery is able to minimise equipment stoppages and thus clearly increase the utilisation factor, i.e. the running time of the coal-getting machines referred to the operating time of the workings. It can be proved that compared to audio-frequency control from underground the use of computer-based control centres and control from the surface with optimum use of all communication facilities substantially improves the utilisation factor as well as the area rate of advance. Sensor development is one of the main

tasks of the future, because it is a prerequisite for partial automation of the individual systems. In addition methods of machine diagnosis and weak point research with incorporation of expert systems still to be developed, come into consideration. Now that control centre technology has been widely adopted for plough and shearer loader operations with caving, work is in progress on extension of this technology also to pneumatic stowing operations as well as to the colliery infrastructure.

43732 (EUR–12101, pp. 56-64) **Automation at the coal faces.** Czauderna, N. (Bergbau AG Niederrhein, Duisburg (Germany, F.R.)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

Automation at the coal face is described as an integrated, total system for the control and supervision of a mine. It is agreed that this can only be partial automation, as full automation cannot be achieved, either technically or economically, with the present mining methods. Winning methods based on the coal plough and on shearer loaders and also face support provide good starting points for the introduction of modern automation techniques. The individual functions that are automatically controlled and monitored and the relating of the separate installations with a 'face' system are described. The profitability of these activities is demonstrated by reference to the utilisation figures for the winning machines and to the reduced proportion of dirt in the gross output. Further development of automation at the face is characterised by the need for improved control of the winning process. Efficient sensors for detecting coal and surrounding rock are not yet available for this purpose. This gap should shortly be filled by increased effort in research and development.

43733 (EUR–12101, pp. 65-78) **Selby spine belt management and control system.** Moore, D. (British Coal Corporation (UK). Selby Coalfield); Bexon, I. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The Selby Coalfield covers an area of 280 square kilometres with total coal deposits of over 2000 million tonnes. Planning consent was granted in the late 1970's to mine 600 million tonnes from the Barnsley Seam. The paper describes the exploration and development of the coalfield, the engineering required to extract over 10 million tonnes per year from the Barnsley seam, changes to the original concept, and the interim arrangements that have been necessary to get mines into production as quickly as possible to recoup an investment of 1.3 billion pounds sterling. A key element of the mining plan is the coal clearance strategy, designed to gather coal from the satellite mines to central distribution points and transport it to the surface at a rate of up to 3000 tonnes per hour through drifts (called spines) on one of two central conveyors. Because of the length of these conveyors, the variable gradients in the drifts, adjustable belt speeds and independently variable coal discharge rates from the bunkers along the spines, maximising coal throughput without exceeding the traction limits of the conveyor drives and without spillage at the transfer points is a complex problem. The paper describes how this is achieved. 8 figs.

43734 (EUR–12101, pp. 79-87) **Control system for hydraulic coal transport network at Sabero Colliery.** Fuentes-Cantillana, J.L. (Asociacion de Investigacion Tecnologia de Equipos Mineros (AITEMIN), Madrid (Spain)); Gullon, A. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

An experimental installation for the hydraulic transport of coal from face to surface has been set up at Sabero Colliery, in Leon province, northwest Spain. The transport network includes 1500 m. of horizontal transport with slurry pumps and 500 m. of vertical transport using the pipe feeder system. The project has financial aid from the European Coal and Steel Community. The control system for the complete network has been developed by Aitemin in close collaboration with the mining company Hulleras de Sabero y Anexas, S.A, and Siemag Transplan GmbH which is the main supplier of mechanical and hydraulic equipment. The purpose of the control system is to obtain a fully automatic operation of the coal transport, together with the necessary supervision. The experimental characteristic of the installation implies some special requirements of the system in order to analyse the network behaviour and to investigate optimisation possibilities. The Spanish Ministry of Energy and Industry provided financial support for the development of the control system. 3 figs.

43735 (EUR–12101, pp. 88-102) **The PHONESAFE long-distance radio communication system for underground.** Hun, J.M. (Lorraine Coalfield, Merlebach (France). Reumaux Colliery); Noel, M. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

With the PHONESAFE system designed by CERCHAR, it is now possible to communicate at any specific moment with personnel travelling long distances on foot or by vehicle underground. Communications are established with radiotelephone type equipment which is permanently-installed or mobile (portable or on board vehicles). The r.f. signals are propagated thanks to the presence of a specially designed 'wave carrier' cable, the CERLIL cable, in the roadways concerned. Repeaters located at intervals in the CERLIL cable network make long-distance connections possible; 20 km of roadways can be covered. An integral part of the system is a device for monitoring the state of the network and its operation. The first PHONESAFE system was installed successfully in a roadway system at the Reumaux colliery in the Lorraine coalfield. Operational since 1985, the 8.8 km communications network has been a great help to locomotive drivers. As the environment corrodes the equipment, the monitoring device is an essential and valuable aid to maintenance. Other systems are in operation in French coal mines. In use, the PHONESAFE system seems to be proving itself a factor in increasing productivity and safety. 3 refs., 16 figs.

43736 (EUR–12101, pp. 137-153) **The collection and utilisation of information by computer to assist in the operational management of Shirebrook Colliery.** Steel, W.T. (British Coal Corporation, London (UK)); Aleman, V.P. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

As collieries become larger and more high cost machinery is employed, the role of the operational manager is becoming more complex and critical. To assist colliery management with this situation, a series of computer based colliery information systems have been developed over the last five years, but these have met with only limited success. The system described in this paper is based on the latest range of powerful mini computers, but more importantly has been developed in partnership with the colliery. Particular care was taken to design the data collection and presentation around criteria that would be practical and relevant for colliery use. The resulting system has now been in operation some 18 months and the colliery management has identified the benefits. It has also shown what are the potential production rates attainable at the colliery and the management has identified areas of future developments. 9 figs.

43737 (EUR–12101, pp. 103-119) **A decentralised system of remote control.** Lavigne, P. (N.V. Kempense Steenkolenmijnende Belgique (Belgium). Research and Development Department); Nijs, J. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

After an account of the remote control systems in existence in the Campine collieries in Belgium with their advantages and

drawbacks, the paper sets out the requirements which a new data-based control system has to meet. The solution adopted differs completely from the conventional ones: it consists of a system of several PCs in a network (LAN). This system is decentralised with respect to the gathering of data but integrated with regard to their processing: The 'control', one of the PCs of the network, prepares a data base (or 'fichier') which is accessible to the other PCs. The integrity of the data is guaranteed. Lastly, a brief description of the components of the system is provided. 12 figs.

43738 (EUR–12101, pp. 154-169) **Integrated system for monitoring a whole mine, (safety, production, etc.), at Gardanne Colliery (Provence Coalfield).** Daret, J. (CERCHAR, Verneuil-en-Halatte (France). Provence Coalfield); Coillard, P.; Saint, P.Y. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The infrastructure extension at Provence (Z and Morandat shafts) was an ideally suitable opportunity for introducing a new generation of monitoring and remote control equipment: the CGA mine air monitoring centre; the APEM intrinsically-safe programmable automatic outstation linked up with other outstations; the LAC-CERISE intrinsically-safe numeric networks; an up-to-date and modular information system for production. The use of this new range of equipment provides undoubted advantages in terms of the safety of men, reliability and the machine utilisation rates. The period of return on investment is short compared with the expected life of the mine. This paper describes the installation of a variety of equipment at Provence and then goes into their individual characteristics in some detail. 6 figs.

43739 (EUR–12101, pp. 170-197) **Data acquisition and information system related to operations and safety at Westerholt Colliery.** Breer, W. (BAG Lippe, Recklinghausen (Germany, F.R.). Westerholt Colliery). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The Westerholt computer system is designed to control operating routines, to monitor safety and operating procedures and to collect and analyse data sets and reports. The data are used at various points around the colliery. The surface control room serves as the information centre. The district control stations and the information points for underground operations, and the control stations for the surface operations, are decentralised. The computer-assisted information system responds to the requirements of the individual hierarchical levels. As much data as possible should be collected in order to eliminate the possibility of human error. 18 figs.

43740 (EUR–12101, pp. 198-205) **The application of expert systems to colliery mining problems.** Bodkin, K.E. (British Coal Corporation, London (UK). Information Technology Dept.). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

Over the last two decades, computer technology has had a radical impact on the efficiency of most modern industries. This impact, however, has largely been confined to those operations which are mechanistic, data intensive or highly numerical. Recent research advances in the field of Artificial Intelligence, together with the considerable power now available in low cost computers, has made it possible to build applications which can support activities which are concerned with the use of knowledge and experience. These Expert Systems provide a means of harnessing the best expertise available within an industry for use throughout the industry. Since 1982 British Coal has been monitoring the development of this new technology and this paper describes the approach adopted in assessing its current status, acquiring experience of it and in applying it to mining operations.

43741 (EUR–12101, pp. 213-221) **Knowledge-based systems for underground operations monitoring.** Steudel, J. (Bergbau-Forschung GmbH, Essen (Germany, F.R.). Fachabteilung Prozessdatenverarbeitung); Huertgen, F. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The state of development of expert systems in German hardcoal mining is discussed by means of two examples to be regarded as pilot projects. Subsequently, possibilities are shown how to use expert systems successfully in operations monitoring, provided basic investigations on response time of the systems yield positive results. Ways of proceeding and problems with developments using the Nexpert development system are discussed for completeness. 2 refs., 6 figs.

43742 (EUR–12101, pp. 222-228) **Utilization of expert systems for machine fault diagnosis.** Villeneuve de Janti, P. (CERCHAR, Verneuil-en-Halatte (France)); Demoulin, J. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The automation of shearers has been an important branch of research at Charbonnages de France for several years; a number of systems have been developed. One example is the data exchange system between the mobile machine supplied by its electric cable and a control station on the surface. The TELSAFE CA remote control system uses the 1000 V supply cable of the shearer as the digitized data carrier. A process control computer, currently sited on the surface, receives and processes the data sent by Telsafe from transducers on board the shearer. Some of the main functions of this computer are: data acquisition and storage; provision of report graphics; calculation of the level of cut; remote control; and breakdown diagnosis. 2 figs.

43743 (EUR–12101, pp. 237-256) **Principles of acoustic radar for fault detection.** Delogne, P. (Catholic University of Louvain, Louvain-la-Neuve (Belgium)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

This paper presents the basic principles of a method for detecting faults in a coal seam by the use of acoustic radar. It firstly gives a brief account of general principles of detection by radar then goes on to review the features of the various methods of propagating acoustic waves, paying particular attention to SH type guided waves. It emphasises the difficulties of signal processing which usually result and shows how these difficulties could be largely overcome by a radar system which uses the SH_0 wave on frequencies in the kHz region. There follows a description of the design of an electro-acoustic exciter. The article then shows how efficient and flexible it can be to process measurements off-line. Finally, there are a few preliminary experiment results. 8 refs., 12 figs.

43744 (EUR–12101, pp. 257-277) **In-seam seismics: experience and progress in the UK.** Jackson, P.J. (British Coal Corporation Stanhope Bretby (UK). Headquarters Technical Dept.); Taylor, P.M.; Buchanan, D.J. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

The in-seam seismic method for detecting geological faults in coal seams has been in regular operational use in the UK for a number of years. Some 700 surveys have now been undertaken with an overall success rate of 87%. This paper describes some of the results obtained and examines some of the limitations to the technique. The emphasis throughout is from the user's point of view with indications of what his expectations should be. The final section gives brief details of some of the work in the current R&D

programme, which is aimed at extending both the range of the method and its applicability. 4 refs., 16 figs.

43745 (EUR–12101, pp. 278-300) **In-seam seismics: a tool for the management of deposits.** Schroeter, P. (Charbonnages de France, Merlebach (France). Technical Dept.); Douay, F. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

More than half the coal produced in France comes from longwall faces, some of which are high performance advancing up to 7 m per day on 150 to 200 m long faces. For this reason, it has become essential for mine operators to explore thoroughly the geological structure of the panels to be worked, in advance. This helps to achieve the predicted level of performance by eliminating faulted coal panels, to achieve optimum productivity and determine the best lay-out of the coal faces in relation to the faults which have been located. In-seam seismics, a geophysical tool, now gives a reliable solution to these problems by providing a decision-making aid on whether a panel of coal is worth working. The method is based on the principle of a guided wave produced by small explosive charges (100 g) and which passes through the coal seam. In order to explore a panel of coal from an in-seam roadway, transmission shots are made to ascertain the speed of propagation as well as reflection shots which locate tectonic irregularities. Between 1982 and 1985, 27 test programmes were carried out in French coalfield s in order to prove this method. Both 1986 and 1987 saw 17 test programmes. Although the method has its limitations, results from these programmes have made it possible for the mine operator to anticipate any geological risks resulting in an appreciable reduction in operating costs. In order to give an idea of the potential savings of this method, exploration of one coal panel is roughly equal to the cost of 15 to 20 m of drivage. 3 refs., 16 figs.

43746 (EUR–12101, pp. 301-310) **Novel information systems in mine surveying in order to improve productivity and safety in the coal industry.** Palm, H.J. (Bergbau AG Lippe, Herne (Germany, F.R.)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

A new planning aid has come to hand for mine surveyors and mining engineers in the form of the tectonic stress chart. This new chart is already developed for extensive areas of Ruhrkohle AG and indeed in use there. A continuous process of comparing projection with reality keeps it constantly updated. This very process adds new findings and confirms earlier ones. In the sphere of geophysics new methods of seam-wave seismics with the SEAMAX 85 and borehole logging are worth noting. Up-to-the minute information about the situation of a face is provided by the continuous face survey system INFONAV, and rapid shaft surveying is assisted by the new IMU system, which works on the principle of inertial navigation to provide guide rail logging to within centimeter accuracy. Modern mine operation needs new methods to prepare a set of mining plans. The introduction of EDP in this field has already started and will expand. It can already be envisaged that mine mapping will be entirely prepared with the help of computer technology before long. In this way not only up-to-date but much additional information can be provided. 8 figs.

43747 (EUR–12101, pp. 311-329) **A performance and condition based maintenance system at Bagworth Colliery.** Dean, R.P.H. (British Coal Corporation (UK). Bagworth Colliery). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

Condition monitoring was introduced into Bagworth Colliery in 1979. This paper shows how it has developed to improve the standard of maintenance and how it has been linked to a new computerised planned preventative maintenance scheme. Details are given of tests done on the face machinery, including armoured flexible conveyor, power packs, powered supports and power loaders. The tests done on Dosco Mk2A roadheading machines used for development work are also included. The very high standard of maintenance and reliability which can only be achieved through the use of condition monitoring is essential when using modern high technology equipment. At Bagworth Colliery hydro-electric powered supports are initiated by the power loader as it passes. The paper describes how craftsmen have been involved in the performance and reliability of their districts. Also described is the weekly summarising of test results and form in which they are presented to management for action. The future plans to use computers for the integration of routine condition monitoring, operational performance and planned maintenance are described. The benefit of this team work is shown in the increase in tonnes/shift produced from faces over the last few years. 12 figs.

43748 (NERDDP-EG–89-198) **Coal dust explosibility on longwall faces.** Gillies, A.D.S. National Energy Research Development and Demonstration Council, Canberra (Australia). 1989. vp. Source: Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

The objective of the project was to provide a comprehensive state of the art report on coal dust explosibility under Queensland longwall mining conditions and in particular to further current knowledge on the explosible potential of lean concentrations of methane/coal dust/air mixtures as found in mine environments. A 20 litre open explosion chamber was constructed to determine the lean explosible limits for German Creek seam coal dust samples and methane mixtures in air. A feature of the project was the development of an opto-electronic dust probe for making instantaneous measurement of coal dust concentration. The project examined coal dust explosibility through a restricted literature review and experimental measurement.

43749 (NERDDP-EG–89-817) **Underground safe coating compounds for ventilation and rib stability.** Howells, M.; O'Connor, L. National Energy Research Development and Demonstration Council, Canberra (Australia). 1989. vp. Source: Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

The object of this project was to test in underground mines a sealant, trade named Deltacoat, previously developed by the proponent organisation. The sealant is an inert, non-flammable, nontoxic, water-based splatter-coating compound with a number of properties which make it useful in reducing air leakages and controlling gas emissions, thereby improving mine ventilation efficiency and reducing the hazards of spontaneous combustion. The trials involved determination of the most effective means of application of the sealant, its application in mine ventilation stoppings, and investigating the reinforcement of coal ribs by the sealant.

43750 (NERDDP-EG–89-820) **Development of pillar design nomograms.** Holman, B. National Energy Research Development and Demonstration Council, Canberra (Australia). 1989. vp. Source: Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

The aim of this project was to produce a series of pillar design nomograms based on existing colliery workings. The project involved underground surveys of mine pillars to gather information for an appropriate data base; surveys of mine plans for pillar dimensions within specified depth ranges; and utilisation of statistical and computing techniques to devise nomograms.

43751 (PB–90-224999/XAB) **Fuel-additive and engine-operation effects on diesel soot emissions. Information circular/1990.** Zeller, H.W. Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center. 12 Jul 1989. 25p. (BUMINES-IC–9238). Source: NTIS, PC A03/MF A01.

Library of Congress catalog card No. 89-600302.

The Bureau of Mines performed laboratory research into the effects of a barium-based fuel additive (the postflame type) on diesel particulate matter (DPM) emissions. The 5.6-L, six-cylinder test engine is typical of types certifiable for use in underground mines. Test parameters consisted of additive concentration and engine loads, speed, and air intake restriction. DPM emissions, including condensed volatiles, were measured gravimetrically. Also

measured were gaseous emissions including carbon monoxide, nitrogen oxides, and hydrocarbons. The fuel additive was effective, reducing DPM up to 75 pct, when used at a concentration of 0.09 wt pct (one-fourth of the concentration recommended by the manufacturer). The additive was most effective at the highest fuel-air ratios, reducing DPM from 400 mg/cu m for untreated fuel to 120 mg/cu m. At light loads, 25 pct of full rated, no DPM reductions were measured. Based on these results, the additive is recommended for use in diesel fuel, at a concentration of 0.09 wt pct, to power underground mining equipment as long as certain conditions are met: that a beneficial DPM reduction is verified, that the minimum required quantity of additive is used, and that potential adverse effects such as increased nitrogen oxides are checked.

43752 (PB–90-229311/XAB) **Coal mining and reclamation operations. Part 1. The determination of the probable hydrologic consequences. Part 2. The statement of the results of test borings or core samplings. Handbook.** Office of Surface Mining Reclamation and Enforcement, Washington, DC (USA). May 1980. 37p. (OSM–119). Source: NTIS, PC A03/MF A01.

The handbook is a general description of an acceptable approach and procedures for collecting and analyzing data for predicting the determination of the probable hydrologic consequences of mining and reclamation operations and for preparing the statement of the results of test borings or core samplings. These provisions are required in the permit application by Sections 507(b)(11) and (b)(15) of the Act. The first part of the handbook contains the procedures for the development of the determination report. Suggested procedures and alternatives for hydrologic data collection and data analysis are discussed. The second part of the handbook contains procedures and alternatives for the development of the statement report. Suggested procedures for identifying potential acidic or toxic properties of the overburden and coal and the first stratum underlying the coal to be mined are discussed. The findings of the determination and statement may be included in separate reports or combined in one report.

43753 (PB–90-229865/XAB) **Potential effects of anticipated coal mining on salinity of the Price, San Rafael, and Green Rivers, Utah. Water Resources Investigation.** Lindskov, K.L. Geological Survey, Salt Lake City, UT (USA). Water Resources Div. 1986. 44p. (USGS/WRI–86-4019). Source: NTIS, PC A03/MF A01.

The overall objective of the report is to describe the potential cumulative impacts of anticipated coal mining on the dissolved-solids concentrations in the Price, San Rafael, and Green Rivers. The changes considered were (1) salt loads in ground water that would be intercepted by mines and discharged to nearby streams in order to dewater the mines and (2) salt loads resulting from surface disturbance associated with the anticipated mining. The anticipated salt loads were estimated from (1) reports prepared under contract with the Office of Surface Mining Reclamation and Enforcement–Cumulative Hydrologic Impact Assessments of several drainages tributary to the Price and San Rafael Rivers that may be impacted by the mining, (2) information from determinations of probable hydrologic impacts in individual permit applications submitted to the Utah Division of Oil, Gas, and Mining, (3) monitoring reports for the National Pollutant Discharge Elimination System furnished to the U.S. Environmental Protection Agency, and (4) other miscellaneous monitoring data for the permit areas.

43754 (PB–90-233818/XAB) **Spalling and the development of a hydraulic-fracturing strategy for coal. Semiannual report, April-September 1990.** Jones, A.H.; Khodaverdian, M.; Morales, R.H.; McLennan, J.D. Terra Tek, Inc., Salt Lake City, UT (USA). Feb 1990. 96p. (TR–90-94). Source: NTIS, PC A05/MF A01.

See also PB–89-159966.

Coal blocks previously recovered from a mine near Marion Center, PA were hydraulically fractured under controlled laboratory conditions. Three successful baseline polyaxial tests were also performed on Torrey Buff sandstone, indicating that the testing program did not produce evident experimental bias. These blocks further substantiated that fluid lag, where the fluid front lags behind the fracture tip, could be a legitimate mechanism for high treatment pressures, at least on a laboratory scale. Further, coal block testing showed that, with low effective confining pressures, nonanomalous treatment pressures were encountered. Numerical analysis, using pseudo-three-dimensional fracture geometry simulation, confirmed the applicability of an unpressurized fluid tip as a possible mechanism for high treatment pressure (experimentally observed in samples subjected to high confinement).

43755 **Method and composition for controlling dust emissions.** Kalau, H. To Department of the Interior, Washington, DC. USA Patent Application 7-480,197. 14 Feb 1990. 19p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The invention relates in general to a method and composition for controlling the emission of dust in a variety of settings, and in particular, to a composition comprising a polyethylene oxide polymer and an anionic surfactant which can be used to enhance the coal-wetting action in a water spray and reduce the emission of coal dust in an underground mining operation.

0130 Transport, Handling, and Storage

Refer also to citation(s) 43685, 43765, 43767

0140 Combustion

Refer also to citation(s) 43654, 43656, 43688, 43697, 43717, 44209, 44486, 44584

43756 (DOE/PC/79915–T9) **Mechanisms of coal-water mixture combustion in fluidized beds: Technical progress report, March 16, 1989–June 15, 1990.** Brown, R.C. Iowa State Univ. of Science and Technology, Ames, IA (USA). [1990]. 12p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79915. Order Number DE90015372. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The third quarter of work on fuel slurry combustion continued on in-situ determination of intrinsic reaction rates. Tracer gas tests with CO_2 were performed to evaluate the validity of our simple models of reaction processes, which led to reinterpretation of some of our results from the previous quarter. We have compared our calcination rate data with previously published rates. We also offer an explanation why calcination in CWM agglomerates appears to be faster than sulfation. Finally, we return to the question of elutriation of unburned carbon and present results from tests with an on-line monitor for unburned carbon. 12 refs., 5 figs., 3 tabs.

43757 (DOE/PC/88929–T5) **Scale-up of circulating fluidized bed coal combustors: Seventh quarter technical progress report, March 1, 1990–May 31, 1990.** Louge, M.Y. Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering. 1990. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88929. Order Number DE90015144. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project is aimed at quantifying the effects of scale-up upon the hydrodynamics of circulating fluidized bed coal combustors (CFB). To this end, we have constructed at Cornell a cold CFB facility that can operate with controlled fluidization gas mixtures. In addition, we have developed new diagnostics to measure local voidage in the bed. In order to test the new facility and its diagnostics, we have used an FCC powder to study in detail the voidage behavior near the wall of the CFB riser. In addition, we have developed a model for the hydrodynamic of the pneumatic transport of large particles, and a model for the transfer of heat in the same regime. These models have shed some light on the flow in regions where the collisional interaction among particles plays an important role. In order to test these models in the CFB, we have begun developing new instruments to measure the collision frequency of particles with the wall of the CFB riser. This quarter, we have completed the first two phases of our scale-up experiments i.e., the fluidization of glass beads and plastic pellets using mixtures of helium and carbon dioxide. For the tests with plastic beads, we have found a remarkable anti-static additive that entirely suppresses electrostatic charging in the bed. We have also begun the third phase of our scale-up experiments and fluidized iron grit using another mixture of carbon dioxide and helium. These experiments,

combined with the data from the glass and plastic bead tests, have provided preliminary indication of the effect of scale-up on the hydrodynamics of CFB coal combustors. 7 refs., 4 figs.

43758 (PB–90-229253/XAB) **Pulverized-coal combustion: Pollutant formation and control, 1970-1980. Final report.** Beer, J.M.; Bowman, C.T.; Chen, S.L.; Corley, T.L.; De Soete, G.G. Radian Corp., Research Triangle Park, NC (USA). May 1990. 658p. Source: NTIS, PC A99/MF A04.

The report documents the support role of EPA's Air and Energy Engineering Research Laboratory in the major research effort directed by EPA in the 1970s to understand pollutant formation during pulverized coal combustion (PCC). Understanding the conversion of fuel nitrogen to nitrogen oxides (NOx) is important, since changes in the combustion process designed to control NOx emission may also influence the formation of soot, polycyclic aromatic hydrocarbons (PAHs), unburned carbon, and the vaporization of inorganic constituents. In addition, reduction of sulfur oxides (SOx) while maintaining low NOx levels is also important. The document is a detailed monograph, written by 19 coauthors, covering such topics as: the high temperature decomposition and combustion of pulverized coal, characterization of coal and coal thermal decomposition, the fate of fuel nitrogen and ash during combustion of pulverized coal particles, kinetic modeling of gas-phase chemistry in coal volatiles combustion, soot and PAH formation in PCC, the combustion rates of pulverized coal char particles, reduction of nitric oxide by solid particles, bench-scale experiments on the formation and control of NOx emissions from PCC, and the optimization of burner/combustion-chamber design to minimize NOx formation during PCC.

43759 (STLE–88-TC-3E-2, pp. 1-7, paper 18) **Tribological properties of some selected materials in a coal-fired environment.** Kamo, R. (Adiabatics Inc. (USA)); Valdmanis, E. Society of Tribologists and Lubrication Engineers, Park Ridge, IL (USA). 1988. (CONF-8810213–:). In *Technical preprint's ASME/STLE tribology conference.* Source: Society of Tribologists and Lubrication Engineers, Park Ridge (USA).

A friction and wear rig simulating a coal-burning environment was designed and fabricated. For the piston ring specimen various substrate materials and coating materials were investigated at room temperature and in a 204°C environment. The behaviour of coal particles, lubricating oil, and coal combustion products was tested on the friction and wear test rig with some valuable data generated.

43760 Erosivity of particles in circulating fluidized bed combustors. Levy, A.V. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Wang, B.Q.; Geng, G.Q.; Mack, W. 12p. National Assoc. of Corrosion Engineers, Houston, TX (USA) (1989). (CONF-890437–: Corrosion '89, New Orleans, LA (USA), 17-21 Apr 1989).

Technical Paper 89543.

The metal wastage of superheater tubes in the convection pass region of circulating fluidized bed combustors (CFBC) is a current problem. An investigation was carried out to determine what kinds of metal loss rates and mechanisms occurred when the various types of particles in CFBC's were used as the erodent in a laboratory blast nozzle tester. The laboratory tests were compared to in-service exposures. A loss mechanism was established that was based on metal losses and the observed microstructures of E-C surfaces. It was additionally determined that more angular and larger size particles have a greater level of erosivity and that the particles must be strong enough not to shatter upon impact in order to be erosive. Favorable comparisons between laboratory and in-service loss mechanisms are reported.

43761 Metal wastage analysis of carbon steel tubes in FBC environment. Sethi, V.K. (Kentucky Energy Cabinet Lab., Lexington, KY (US)); Puentes, E.; Natesan, K. 16p. National Assoc. of Corrosion Engineers, Houston, TX (USA) (1989). (CONF-890437–: Corrosion '89, New Orleans, LA (USA), 17-21 Apr 1989).

Technical Paper 89537.

The TVA 20-MW AFBC Pilot Plant located near Paducah, Kentucky began operations in March 1982, and it operated with the same in-bed evaporator tubes (tube bundle B1) for ~13,625 h through the end of 1985. During January-February 1986, the evaporator tubes were removed to test a new tube bundle configuration (tube bundle C1). After only a short period of operation, tube diameter measurements show that tube wastage rates for bundle C1 were almost an order of magnitude larger than those recorded for B1. Although several other changes could have been responsible for this increase, the consensus at the TVA was that the increase probably occurred because the pilot plant switched coals from a low chlorine (0.02%) to a high chlorine (~0.30%) KY No. 9 coal. In order to determine the validity of the role of chlorine in increasing the tube wastage, several tube sections were cut out from the plant and analyzed. The results of the chemical and metallographic examination are reported.

43762 Modeling of oxygen chemisorption kinetics on coal char. Khan, M.R. (Texaco, Inc., Beacon, NY (USA)); Everitt, C.E.; Lui, A.P. *Combustion and Flame (USA),* 80(1): 83-93 (Apr 1990).

It has been demonstrated that the char active surface area (ASA) is a relevant parameter for evaluating the reactivity of low- and high-temperature coal chars. The kinetics of oxygen chemisorption by coal chars is important for evaluating the autoignition potential of pyrolysis chars during temporary storage or transport and to investigate the mechanisms involved in oxygen chemisorption, as heterogeneous combustion is influenced by the chemisorption of oxygen on char surface. Rates of oxygen uptake by char at a range of chemisorption temperatures were monitored using a thermogravimetric balance. Oxygen chemisorption rate data on low-temperature (500°C) coal char at various temperatures have been tested with three kinetic models and one diffusion model. Furthermore, chemisorption data from a low-temperature (500°C) char have been compared with data from a high-temperature (950°C) char. Chemisorption between 100° and 215°C was investigated. Possible controlling mechanisms suggested by each model are presented.

43763 A combustion/deposition entrained reactor for high-temperature/pressure studies of coal and coal minerals. Anderson, R.J. (USDOE Morgantown Energy Technology Center, Morgantown, WV (USA)); Logan, R.G.; Meyer, C.T.; Dennis, R.A. *Review of Scientific Instruments (USA),* 61(4): 1294-1302 (Apr 1990).

The combustion of coal and coal-derived fuels in heat engines poses significant technical challenges in terms of establishing high combustion rates and efficiencies, controlling emissions, and minimizing the impact of fuel contaminants on engine components. An entrained reactor has been designed and constructed to study coal particle combustion, the tendency of coal ash to form deposits on heat engine components, and the effects of fuel additives on residual ash composition. The reactor is designed for high temperature/pressure conditions similar to those of a coal-fired gas turbine. Optical access ports and advanced instrumentation allow the in situ measurement of gas and particle temperatures, and vapour phase alkali concentrations. The reactor has been used to study the deposition potential of several coals as a function of process conditions, and to determine the effects of selected additives on the deposition rate. 14 refs., 12 figs., 2 tabs.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 43702, 43716, 43834, 43835, 44204, 44207, 44471

43764 (DOE/FE/61811–T4) **Trends in thermal coal trade and projections of global patterns in 2000.** Kulp, J.; Totto, L. East-West Center, Honolulu, HI (USA). Energy Program. Apr 1990. 23p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG03-89FE61811. Order Number DE90015687. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The trend of increasing overseas trade in thermal coal is expected to continue throughout the 1990s. The projected levels of trade for this decade suggest growth in the range of 5.8 percent per year (East-West Center) to 7.3 percent per year (International Energy Agency/Institute of Energy Economics, Japan). With much of the incremental rise in imports forecast to come from Asian nations, further redirection of thermal trade flows is expected. It is the

intent of this paper to review the outlook for the ocean-borne thermal coal market in 2000 and provide projections of import and export flows that will satisfy global import demand, given technical, economic, and geographical supply constraints. Some broad strategies for coal exporters and importers will be discussed based on the findings of this paper. 8 tabs.

43765 (DOE/FE/61811–T5) **Summary of Asia-Pacific coal news, second quarter 1990.** Baseer, N.A. (comp.). East-West Center, Honolulu, HI (USA). Energy Program. Jul 1990. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG03-89FE61811. Order Number DE90015688. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Coal Mining Developments, Transport and Utilization Developments of coal in Asia and Australia are briefly summarized. Information for this report has been collected from the trade press as well as from data files of the Asia-Pacific Coal Project at the East-West Center.

43766 (DOE/FE/61811–T6) **Summary of Asia-Pacific coal news, first quarter 1990.** Baseer, N.A. (comp.). East-West Center, Honolulu, HI (USA). Energy Program. Apr 1990. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG03-89FE61811. Order Number DE90015689. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Coal mining developments, transport and utilization developments of coal in Asia and Australia are briefly summarized.

43767 (DOE/FE/61811–T7) **Summary of Asia-Pacific coal news, fourth quarter 1989.** Baseer, N.A. (comp.). East-West Center, Honolulu, HI (USA). Energy Program. Mar 1990. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG03-89FE61811. Order Number DE90015690. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Coal Mining Development, Transport and Utilization Developments of coal in Asia and Australia are briefly summarized. Information for this report has been collected from the trade press as well as from data files of the Asia-Pacific Coal Project at the East-West Center.

43768 (DOE/FE/61811–T8) **The dynamics of the expanding coal supply in the Asia-Pacific region.** Kulp, J.; Fesharaki, F.; Wilson, P. (eds.). East-West Center, Honolulu, HI (USA). Resource Systems Inst. ©1989. 204p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG03-89FE61811. Source: Resource Systems Institute, East-West Center, Honolulu, Hawaii 96848.

This volume is one of the product of the Asia-Pacific Coal Project of the East-West Center. The project analyzes thermal coal market interactions and the competitive forces that drive thermal coal consumption in the utility, commercial, and household sectors. The research includes country studies of thermal coal supply and demand, regional supply and demand balance analyses, and computer modelling of international trade patterns. Thermal coal and clean coal technology trading opportunities across the Asia-Pacific region are the focus of a major two-year study funded by the US Department of Energy. This study is analyzing supply-demand constraints and structural trends in the thermal coal trade, assessing international competitiveness, and identifying opportunities for clean coal technology exports. 67 refs., 21 figs., 85 tabs.

43769 (GAO/NSLAD–89-42) **International energy agency: Effectiveness of members' oil stocks and demand restraint measures.** General Accounting Office, Washington, DC (USA). National Security and International Affairs Div. Feb 1989. 44p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the 1974 International Energy Program Agreement, which created the International Energy Agency, and provides for an Emergency Oil Sharing System. Signatory countries are to maintain emergency reserves sufficient to sustain their consumption for at least 90 days with no net oil imports and establish measures for restraining oil demand and sharing oil supplies during supply disruptions. IEA has made progress in recent years in improving its information about and evaluations of emergency oil stocks and demand restraint programs. Although most member countries technically comply with IEA's 90-day stock requirement, many lack 90 days of accessible emergency oil stocks.

43770 (GAO/RCED–8963SF) **Oil reserve: Status of strategic petroleum reserve activities as of September 30, 1988.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Feb 1989. 22p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the purpose of the Strategic Petroleum Reserve which is to store up to 1 billion barrels of crude oil for use if an oil supply disruption occurs. As of September 30, 1988, the SPR inventory totaled 554.7 million barrels of oil. For all of FY 1988 the Department of Energy disbursed $338 million for oil acquisition and transportation.

43771 (NERDDP-EG–89-799) **Production disruptions - Australian coal mining industry 1977-1987.** Mills, J.A. National Energy Research Development and Demonstration Council, Canberra (Australia). 1989. vp. Source: Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia.

This study focuses on human factors which have contributed to production disruption in the coal mining industry in New South Wales and Queensland in the years 1977-87. The report includes an analysis of industry characteristics in terms of output, employment and productivity during the decade, as well as a description of industry bodies and mechanisms which regulate the system. The report highlights the significance of production disruption caused by accident/injury, illness and industrial disputes.

43772 (PB–90-230442/XAB) **Minerals yearbook: The mineral industry of the republic of South Africa. 1988 international review.** Morgan, G.A. Bureau of Mines, Washington, DC (USA). 1988. 37p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The mineral industry remained buoyant in 1988 with generally higher prices for mineral commodities leading to higher output. As a result, numerous capacity expansion projects were underway or planned at mines, mills, and refineries. Among these projects were new gold, platinum-group metals, vanadium, and zirconium mines, and additional ferrochromium capacity. Mining and quarrying accounted for $10 billion of a gross domestic product (GDP), at 1988 prices, of $79 billion. Total mineral sales, including domestic sales and exports, were $15.1 billion, which was divided by commodities as follows: gold, $8.7 billion; coal, $2.6 billion; copper, $519 million; manganese, $149 million; limestone and lime products, $143 million; and chromite, $138 million. Exports of vanadium, of which South Africa was the world's largest producer, were $145 million. Topics covered in the report include the following: Government policies and programs; Production and trade; Commodity review–Metals, industrial minerals, and mineral fuels.

43773 (PB–90-230459/XAB) **Minerals yearbook: The mineral industry of Canada. 1988 international review.** Gurmendi, A.C. Bureau of Mines, Washington, DC (USA). 1988. 27p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The Canadian mining industry made impressive gains in 1988. The strong momentum was expected to continue through 1989. Mining is a thriving industry within the Canadian economy. Canada is among the world's mining leaders, but mining is not its leading industry; it contributes 25% of the total value of Canada's exports. In 1988, mining employed about 392,000 workers, an increase of 6,000 workers from 1987. Topics discussed in the report include the following: Government policies and programs; Production; Trade; Commodity review–metals, industrial minerals, and mineral fuels.

43774 (PB–90-231838/XAB) **Minerals yearbook, 1988: peat.** Cantrell, R.L. Bureau of Mines, Washington, DC (USA). 1988. 14p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

U.S. peat production within the 48 contiguous States declined 6% in 1988. Producers' sales volume and average price received per ton, decreased 3% and 2%, respectively. Ending stocks at the producer level increased 5%. Apparent domestic consumption was

5% below the record 1.5 million tons established during 1986 and 1987. Peat imports increased 15% and reached a record 0.6 million tons, representing 40% of apparent domestic consumption. Canada shipped over 99% of the total. Sphagnum moss sales tonnage increased 142% during the year principally due to development of new high-quality deposits in Minnesota. A significant decline in humus production and sales was experienced.

43775 (PB–90-232513/XAB) **Minerals yearbook: The mineral industry of the Federal Republic of Germany. 1988 international review.** Rabchevsky, G.A. Bureau of Mines, Washington, DC (USA). 1988. 17p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The Federal Republic of Germany (FRG) was one of the world's major processors, refiners, and consumers of minerals and metals. The area of the FRG was about the same as that of Oregon, with a population of 61.1 million, down from 61.7 million in 1984. The FRG remained a significant producer of steel and the processor of selected nonferrous metals, potash, and coal. Except for lignite, potash, and salt, and some lead and zinc, the mining industry was declining. The FRG has a long history of mining and metals production and was relatively well endowed with certain mineral resources. In 1988, 8 of the FRG's 11 underground noncoal mines were potash and salt mines. The others were producing lead, pyrite, silver, and zinc. Topics covered in the report include the following: Production; Trade; Commodity Review–Metals, Industrial minerals, and Mineral fuels.

43776 (PB–90-236928/XAB) **Minerals yearbook: The mineral industry of Brazil. 1988 international review.** Ensminger, H.R. Bureau of Mines, Washington, DC (USA). 1988. 27p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

Brazil's gross domestic product (GDP) grew only slightly in 1988 to $277 billion at current prices. The growth rate was the smallest registered since 1983, when the rate was minus 2.8%. The economy's performance was strongly influenced by a 2% to 3% decrease in industrial production and civil construction. The mineral industry, however, countered the downward trend in the industrial sector and grew a modest 1.4%. Topics discussed in the report include the following: Government policies and programs; Production; Trade; Commodity review–Metals (Aluminum, Aluminia, and Bauxite, Columbium, Copper, Gold, Iron and Steel, Manganese, Tin, Titanium); Industrial Minerals (Gem stones, Phosphate rock, Quartz); Mineral fuels (Coal, Natural gas, Petroleum, Nuclear power); Nonmineral energy sources (Alcohol, Hydroelectric).

43777 (PB–90-502378/XAB) **US coal production and related data, 1986-1988. Data file.** Balthasar, N.C.; Swann, T.C.; Young, P.F. National Energy Information Center, Washington, DC (USA). 1988. mag ta Source: NTISCP T02.

See also PB–87-229258; Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products.

The file contains comprehensive annual U.S. coal production and related data for 1986-1988 on coal production, the number of mines, prices, productivity, employment, daily productive capacity, reserves and stocks. Data are obtained annually from Form EIA-7A, Coal Production Report, a survey of companies owning and/or operating mining operations that produced, processed or prepared coal in the U.S. Each year the data are published in the Energy Information Administration's Coal Production Report (DOE/EIA-0118). The file is updated annually.

0160 Health and Safety

Refer also to citation(s) 43695, 43720, 43721, 43722, 43724, 43725, 43726, 43748

43778 (EUR–12101, pp. 206-212) **Application of expert systems to mine safety inspection.** Samaniego Bordiu, J. (AITEMIN, Madrid (Spain)); Silva Castano, F.; Alarcon Rojas, D. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8805383–: Information symposium on improving productivity through technology, Luxembourg (Luxembourg), 4-6 May 1988). In *Modern management in the coal-mines.* Source: Verlag Glueckauf, Essen (Germany, F.R.).

A series of mine safety inspection programs throughout Spain has been started in the last two years. The role of AITEMIN in the safety programs was to physically inspect the mines, check their safety measures and equipment against the mining law, and suggest the appropriate changes or administrative requirements to the authorities. Based on the experience obtained during the development of those programs, AITEMIN is currently involved in the development of a computerized system to help mine safety inspectors to do their job. The objectives are to incorporate their experience in form of rules into an expert system, hence creating a tool to help them perform their inspection more efficiently. 4 refs., 3 figs.

43779 (IOM-TM–90-01) **The natural history and implications of irregularly-shaped small shadows on coalminers' chest radiographs.** Miller, B.G.; Campbell, S.J.; Cowie, H.A.; Hurley, J.F.; Jacobsen, M.; Muirhead, M.J.; Bennett, J.G.; Dick, J.A.; Pern, P.O.; Rickards, M.A.; Thomas, D.J. Mar 1990. 119p. Source: Institute of Occupational Medicine, Edinburgh (UK).

Coalworkers' simple pneumoconiosis is diagnosed in life by the presence on a chest radiograph of small opaque shadows. In most cases, these are rounded in shape, with diameter up to about 10 mm. Certain other mineral pneumoconioses are typified by opacities of irregular shape, but many researchers have reported that some coalworkers' radiographs show some irregular opacities. There has been disagreement about the relevance of such observations to the assessment of occupational disease in coalworkers, particularly since irregular opacities have been observed in older cigarette smokers without substantial occupational exposure to mineral dusts, and many British coalminers smoke cigarettes. This study extends earlier work on irregular opacities, based on radiographs and data collected during the British coal industry's Pneumoconiosis Field Research (PFR) programme. 3669 radiographs were studied, from the records of 707 men. The radiographs were examined and classified independently, according to the ILO (1980) Classification scheme, by each of five experienced Medical Officers from the coal industry. These readers worked independently, and examined and classified initially the series of the first four films from each man. Films from the later surveys were then presented and classified, and where this led to revision of a reader's opinion of any of the earlier films, the revised classification was recorded. In practice, there were few revisions. The principal conclusion is that, on present evidence, it is not of major importance to distinguish small rounded from small irregular opacities in epidemiological studies of coalminers' lung diseases; and that estimates from historical studies of the risk of advanced simple pneumoconiosis of Category 2 or more are not seriously deficient as a result of being based on rounded opacities only.

43780 (IOM-TM–90-02) **Studies of the Scottish oil shale industry. Volume 1: a socio-historical study of Scottish shale mining communities in Mid and West Lothian.** Randall, S.C. Mar 1990. 91p. Source: Institute of Occupational Medicine, Edinburgh (UK).

An oral history of life in the first half of the twentieth century in the shale mining communities of Mid and West Lothian, Scotland provided background information needed for a mortality study of these communities where the Scottish shale oil industry was located until 1963. Thirty-two semi-structured interviews with 41 old people provide a detailed socio-historical picture of life in an area dominated by this study. Much of the information is presented using quotations from the interviews. Housing conditions and perceptions of pollution are described. Details of working conditions, jobs and wages, focussing in particular on the shale industry, suggest that until the early 1920s shale workers were financially well off compared with workers elsewhere. Comparative wage levels then deteriorated until 1939. Women's activities, roles, domestic and work positions indicate that although women had little exposure to industrial hazards in the workplace, their standard of living was very low and they had to work extremely hard. Health and health care, diet, smoking and drinking habits, leisure and migrations are other factors which could affect mortality patterns. Comparisons

with contemporary studies show that, although the shale communities were poor with bad living conditions compared to today, there is no evidence that they were any worse off than contemporary working class communities, and thus no reason to expect that overall mortality levels should be raised. 32 refs., 6 tabs.

43781 (IOM-TM–90-03) **Studies of the Scottish oil shale industry. Volume 2: mortality in the Scottish shale mining communities.** Randall, S.C.; Cowie, H.A.; Hurley, J.F.; Jacobsen, M. Mar 1990. 131p. Source: Institute of Occupational Medicine, Edinburgh (UK).

This study aimed to identify any adverse impact of the shale industry on mortality in communities in Scotland where shale was extracted and processed until 1962, when the industry closed. Civil Parishes in the study area were classified as 'Shale', 'Coalmining' or 'Rural' according to levels of shale and coal industry activity during or shortly before those periods over which mortality was monitored. Information about the population at risk in these areas, and mortality was obtained primarily from official sources, supplemented by ad hoc investigations of specific problems. Mortality analyses focussed on malignant causes 1953-81 and non-malignant causes 1963-81; mortality from all causes, 1911-31, was also examined. There was no evidence that mortality 1911-31 among men or women in the shale areas was higher than in coalmining areas locally, or in selected other Scottish regions. Among men, non-malignant mortality 1963-81 was higher in the shale than in other industrial areas, probably reflecting social factors (e.g unemployment following decline of the shale industry) rather than a direct effect of previous shale production. As anticipated, there was excess mortality from pneumoconiosis in the coalmining parishes, and from skin cancer in the shale areas. Other analyses of malignant causes 1953-81 suggested increased risks of bladder cancer and (among men) of other genito-urinary cancer in parishes where the shale industry had been concentrated. 27 refs., 18 figs., 31 tabs.

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 43788, 43897, 44420, 44460

43782 (AD-A–220938/5/XAB) **Tensile strengths of problem shales ar.d clays. Master's thesis.** Rechner, F.J. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). 1990. 123p. (AFIT/CI/CIA–90-008). Source: NTIS, PC A06/MF A01.

The greatest single expense faced by oil companies involved in the exploration for crude oil is that of drilling wells. The most abundant rock drilled is shale. Some of these shales cause wellbore stability problems during the drilling process. These can range from slow rate of penetration and high torque up to stuck pipe and hole abandonment. The mechanical integrity of the shale must be known when the shalers are subjected to drilling fluids to develop an effective drilling plan.

43783 (BNL–43811R) **A perfluorocarbon tracer transport and dispersion experiment in the North Sea Ekofisk oil field.** Senum, G.I.; Dietz, R.N.; D'Ottavio, T.W.; Goodrich, R.W.; Cote, E.A.; Spandau, D.J. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 67p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-76CH00016. Order Number DE90000248. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A perfluorocarbon tracer (PFT) transport and dispersion experiment has been performed in the Ekofisk section of the North Sea Oil fields. Fifty grams each of three PFTs were injected into a well and 28 surrounding wells were sampled for the presence of PFT. Sampling was accomplished by initially collecting bottles of reservoir hydrocarbon gas and subsequently transferring 5 liter (gas phase) aliquots onto Capillary Adsorbent Tracer (CAT) samplers. The resulting CATS samplers were analyzed for PFT in a specially configured laboratory gas chromatograph with electron capture detection. The limit of detection for PFT as determined by standard addition experiments was circa 1 to 10 femtoliters (10^{-15} L) per liter of sampled reservoir gas. Sampling was performed up to two years past the injection time; approximately two hundred samples were analyzed. PFT was observed only in four sampling wells at four different times, though the PFT analysis of earlier samples lack sufficient sensitivity to PFT detection due to a hydrocarbon interferent problem which was resolved during this experiment. 5 refs., 28 figs.

43784 (DOE/EIA–0523(89/4Q)) **International oil and gas exploration and development activities: Quarterly report, fourth quarter 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 15 May 1990. 51p. Sponsored by U.S. DOE Management & Administration. Order Number DE90016014. Source: NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

This report is part of an ongoing series of quarterly publications that monitors discoveries of oil and natural gas in foreign countries and provides an analysis of the reserve additions that result. Preparation of the report is performed by the Energy Information Administration (EIA) of the US Department of Energy (DOE) under the Foreign Energy Supply Assessment Program (FESAP). A summary of discoveries and reserve additions that result from recent international exploration and development activities is presented. EIA believes that this information is useful to petroleum industry analysts, various government agencies, and political leaders for the development, implementation, and evaluation of energy policy and legislation. 23 refs., 9 figs., 4 tabs.

0203 Drilling and Production

Refer also to citation(s) 44264, 44265, 44275, 44276, 44428, 44460

43785 (CANMET–89-04495) **A study of bacterial plugging of thief zones during oil field drilling: Final report.** Taylor, S.K.; Costerton, J.W. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 31 Mar 1989. 30p. CONTRACT EMR 23440-8-9178/01-SQ. (MICROLOG–89-04495). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

An initial study was performed which demonstrated that a Bacillus species, isolated from the Salton Sea in California, grew well and produced excessive amounts of polymer in loose sand and gravel and in the presence of drilling mud. Six cylindrical core experiments later showed that the Bacillus species and a Pseudomonas species isolated from a produced water source in Harmattan, Alberta also grew well and produced polymer in packed sand and gravel cores and in the presence of drilling mud. Permeabilities of the cores were reduced by > 99% in all cases, except when bacteria were absent. The vegetative Bacillus and Pseudomonas cultures plugged the cores in the shortest period of time. Plugging profiles of the Bacillus spores were similar except that the richer the nutrient the sooner they plugged. Analysis of the core sections for viable cell counts and carbohydrate production indicate high numbers of cells and polymer production. Colony counts and polymer production were the highest in the core containing the Pseudomonas injected with sodium citrate medium. Cores containing the Bacillus spores had similar colony counts to each other but polymer production was significantly lower in the core without the drilling mud. Scanning electron microscopy revealed that bacteria moved down the length of the core and developed a biofilm which was responsible for the decrease in core permeability. 2 refs., 8 figs., 2 tabs.

43786 (DOE/BC/10847–20) **Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Final report, 1988–1989.** Wasan, D.T. Institute of Gas Technology, Chicago, IL (USA). Aug 1990. 137p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-85BC10847. Order Number DE90000253. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Experimental and theoretical studies were conducted to advance understanding and predictability in the successful application of the combined surfactant-enhanced alkaline flooding for tertiary oil

recovery. An experimental investigation of the buffered surfactant-enhanced alkaline flooding system chemistry was undertaken to determine the influence of the various species present on interfacial tension and phase behavior. The minimum in interfacial tension and the region of spontaneous emulsification correspond to a particular pH range, so that by buffering the aqueous pH against changes in alkali concentration, low interfacial tension can be maintained when the amount of alkali decreases due to the influence of external factors, such as divalent ions, acids, rock consumption, and dispersion. Reflected light micro-interferometry study was conducted to observe stratification in thin liquid films (associated with emulsion and foam systems) formed from micellar solutions of nonionic surfactants, such as ethoxylated alcohols. We show in the case of micellar solutions of nonionic surfactants that the stratification which results in the enhanced stability of films (and therefore the colloidal dispersion) is very sensitive to temperature. A new microwave interference dielectrometer was developed for characterizing oil-in-water and water-in-oil macroemulsions. The apparatus is readily applicable to either on-line or laboratory measurements. The dielectric properties of macroemulsions in the microwave frequency region were analyzed using interaction potential models and effective medium theories. 151 refs., 60 figs., 4 tabs.

43787 (DOE/BC/14000–3) **Production potential of unrecovered mobile oil through infield development: Integrated geologic and engineering studies: Overview.** ICF Resources, Inc., Fairfax, VA (USA); Texas Univ., Austin, TX (USA). Bureau of Economic Geology. Aug 1990. 115p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86BC14000. Order Number DE90000255. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report is part of a coordinated series of research efforts designed to prepare preliminary evaluations of important components of the domestic unrecovered oil resource. Integrated geologic, engineering, and economic evaluations in this series estimate future reserve additions from this unrecovered mobile oil (UMO) resource under various circumstances. Individual studies consider the effects of changes in oil prices and advances in production technology on the economic recovery potential of the UMO resource. This report discusses and compares the approaches and results of the individual studies. Several recovery technologies are evaluated, including the use of waterflooding in conjunction with infill drilling to displace and produce UMO at decreased well spacings. The overall analysis series was conducted in two separate parts: at a detailed reservoir level and at a generalized regional level. At the reservoir level, detailed analyses of three individual Texas reservoirs fully delineated the resource and the potential for UMO recovery in each reservoir under a variety of development situations. Results of the evaluations were extrapolated to groups of reservoirs with common depositional histories, collectively known as "plays". At the regional level, reservoirs in Texas, Oklahoma, and New Mexico, were analyzed to determine the resource volume, potential recovery, and the costs and benefits associated with this recovery both in the individual states and for the region as a whole. This analysis relied on the geologic classification of individual reservoirs, specific rock and fluid properties, and production and development histories.

43788 (DOE/BC/14000–4) **An assessment of the reserve growth potential of the San Andres/Grayburg carbonate (South Central Basin Platform) play in Texas.** ICF Resources, Inc., Fairfax, VA (USA); Texas Univ., Austin, TX (USA). Bureau of Economic Geology. Aug 1990. 147p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86BC14000. Order Number DE90000256. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Reserve growth from infield exploration and extended field development is emerging as a major source of domestic crude oil reserves. Infill and extension drilling have provided the bulk of recent reserve additions both nationally and in key oil producing states. The purpose of this study is to begin to develop an alternative approach to estimating reserve growth. This approach uses detailed geologic and engineering-based analyses to estimate the volume of economically recoverable hydrocarbons from infill drilling. This report presents the results of the first of several phases of this study – the estimate of economically recoverable hydrocarbons from the San Andres/Grayburg Carbonate (South Central Basin Platform) Play, a collection of 19 fields in the Permian Basin of West Texas. This study describes the methodology that was used to determine the increase in contacted reservoir volume that results from more closely spaced infill wells, discusses the approach used to calculate recoverable oil and associated natural gas, and concludes with an economic analysis of the reserve growth potential for the play. 26 refs., 34 figs., 40 tabs.

43789 (DOE/BC/14000–5) **An assessment of the reserve growth potential of the Clear Fork Platform carbonate play in Texas.** ICF Resources, Inc., Fairfax, VA (USA); Texas Univ., Austin, TX (USA). Bureau of Economic Geology. Aug 1990. 77p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86BC14000. Order Number DE90000257. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report is part of a coordinated series of research efforts designed to prepare preliminary evaluations of important components of the domestic unrecovered oil resource. Integrated geologic, engineering, and economic evaluations in this series estimate future reserve additions from this unrecovered mobile oil (UMO) resource under various circumstances. Individual studies consider the effects of changes in oil prices and advances in production technology on the economic recovery potential of the UMO. This report discusses and compares the approaches and results of the individual studies. Several recovery technologies are evaluated, including the use of waterflooding in conjunction with infill drilling to displace and produce UMO at decreased well spacings. The overall analysis series was conducted at a detailed reservoir level and at a generalized regional level. At the reservoir level, detailed analysis of three individual Texas reservoirs fully delineated the resource and the potential for UMO recovery in each reservoir under a variety of development situations. Results were extrapolated to groups of reservoirs with common depositional histories, collectively known as "plays." At the regional level, reservoirs in Texas, Oklahoma, and New Mexico were analyzed to determine the resource volume, potential recovery, and the costs and benefits associated with this recovery. This analysis relied on the geologic classification of individual reservoirs, specific rock and fluid properties, and production and development histories to quantify the resource and to assess its potential for UMO recovery potential. The initial methods and results at both levels were compared in order to calibrate and to modify the final approach at each level and can now be used as a guide in future analyses. 22 refs., 19 figs., 17 tabs.

43790 (DOE/BC/14126–16) **A study on Newton related nonlinear methods in well test analysis, production schedule optimization and reservoir simulation.** Barua, J. Stanford Univ., CA (USA). Petroleum Research Inst. Aug 1990. 111p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87BC14126. (SUPRI-TR–70). Order Number DE90000249. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This is a study on the use of alternative nonlinear methods in automated well test analysis, production and injection schedule optimization and in reservoir simulation. In automated well test analysis the advantages and disadvantages of second-order partial derivatives are investigated. Newton's method is shown to be prone to difficulties, however by adjusting the eigenvalues of the Hessian matrix, the performance can be substantially improved. In optimizing the cyclic steam injection process, Newton's method is compared with the Quasi-Newton method using a simplified model to simulate the process. Specific operating strategies for the process are identified. The two methods are then compared in reservoir simulation. Tests show that while it is possible to use the Quasi-Newton method to build up inverse Jacobians as the iterations proceed, for difficult problems the method requires the use of matrix solution techniques. The method then becomes directly comparable to Newton's method. Tests show that depending upon the linear scheme used, and the difficulty of the problem, the Quasi-Newton method may prove to be less expensive than Newton's method in certain cases. The study also addresses the issue of building scalable parallel reservoir simulators. Residual constraints are used to improve the robustness of the parallel matrix solution scheme. The solution of the constraint matrix is shown to be a critical point in achieving good performance on a parallel machine. 60 refs., 47 figs., 18 tabs.

43791 (DOE/BC/14126–20) **The accurate measurement of heat flux using thin film heat flux sensors with application to petroleum engineering.** Shallcross, D.C.; Wood, D.G. Stanford Univ., CA (USA). Petroleum Research Inst. Jul 1990. 59p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87BC14126. (SUPRI-TR–74). Order Number DE90000236. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A thorough understanding of the thermal processes occurring within an experimental system is usually vital in correctly interpreting experimental observations, yet most researchers rely solely on temperature-measuring devices such as thermocouples to study these thermal processes. Heat flux is a process variable that is rarely, yet readily measured. This report details how commercially-available thin film heat flux sensors may be used within the petroleum engineering laboratory to accurately measure heat flux. To illustrate the proper application of the sensor and the correct interpretation of the experimental results, a laboratory investigation is described. Five thin film heat flux sensors were used to study heat transfer processes occurring within a one-dimensional sandpack which was first steam flooded, then injected with a surfactant solution and a non-condensible gas to spontaneously generate steam foam. The sensors were attached to the outside of the sandpack beneath a layer of insulation. Their use allowed parameters such as the steam front velocity and inclination, and the quality of the produced steam to be determined. Variations in the rates of heat transfer from the sandpack to the surroundings proved to be significant with both time and position along the one-dimensional model. The sensors proved to be valuable tools in understanding the heat transfer mechanisms occurring within the system and correctly interpreting the experimental results. 12 refs., 17 figs.

43792 (DOE/BC/14126–22) **SUPRI heavy oil research program thirteenth annual report, October 1, 1988–September 30, 1989.** Brigham, W.E.; Ramey, H.J. Jr.; Castanier, L.M. Stanford Univ., CA (USA). Petroleum Research Inst. Aug 1990. 131p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87BC14126. (SUPRI-TR–76). Order Number DE90000250. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This annual report presents progress on heavy oil research in the following areas: flow properties, including a discussion on the use of computerized x-ray tomography; in-situ combustion; steam with additives and foam flow; reservoir definition; and field support services. References, figures, and tables may be included with each topic. (CBS)

43793 (DOE/BC/14126–25) **Theoretical development of flow into a well through perforations.** Ahmed, G.; Horne, R.N.; Brigham, W.E. Stanford Univ., CA (USA). Petroleum Research Inst. Aug 1990. 125p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87BC14126. (SUPRI-TR–77). Order Number DE90000251. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

A theoretical solution to flow into a well via perforations is synthesized using Green's functions. The solution is three dimensional and applies to steady-state single phase homogenous flow. The complete solution for a cylindrical perforation involves double infinite summation and triple integration and is difficult to compute. A useful approximation is made by treating the perforation as a line-sink; this reduces the solution to a double infinite summation and a single integration. The solution contains expressions of Bessel functions and their derivatives. The infinite summation is over the order and the argument of these functions. An array of eigenvalues are first computed from an implicit equation. These engienvalues are then used for computation of a solution. The solution involves five physical parameters: wellbore diameter, perforation diameter, perforation length, perforation density (vertical spacing) and phasing (angular spacing). These parameters influence the cost as well as the efficiency of a well completion. A sensitivity analysis can be done for an optimization of the completion design using this analytical solution. Perforation length is the most important parameter and performance improves with increasing length. Initially, even a small increase in length gives a significant improvement. Perforation density is an important parameter, but beyond an optimum number of shots per foot there is little gain in productivity ratio. This result will lead to a saving of cost, since a higher shot density is generally used by industry. The phasing of perforations influences the performance. A phasing of 90° in the same horizontal plane or along a spiral gives a significant advantage over 0° phasing, and this improvement increases with an increase in perforation length. 38 refs., 35 figs., 5 tabs.

43794 (DOE/BC/14126–26) **Effect of metallic additives on in situ combustion of Huntington Beach crude experiments.** Baena, C.J.; Castanier, L.M.; Brigham, W.E. Stanford Univ., CA (USA). Petroleum Research Inst. Aug 1990. 77p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87BC14126. (SUPRI-TR–78). Order Number DE90000259. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The economics and applicability of an in-situ combustion process for the recovery of crude oil are dictated to a large extent by the nature and the amount of fuel formed during the process. The aim of this work is to use combustion tube studies to determine on a quantitative basis, how the nature and the amount of fuel formed could be changed by the presence of metallic additives. These experiments follow from the qualitative observations on the effect of metallic additives on the in-situ combustion of Huntington Beach crude oil made by De los Rios (1987) at SUPRI. He performed kinetic studies on the oxidation of Huntington Beach crude in porous media and showed that the nature of the fuel formed changed when metallic additives were present. Combustion tube runs were performed using the metallic additives: ferrous chloride ($FeCl_2.4H_2O$), zinc chloride ($ZnCl_2$) and stannic chloride ($SnCl_4.5H_2O$). Unconsolidated cores were prepared by mixing predetermined amounts of an aqueous solution of the metal salt, Huntington Beach crude oil, Ottawa sand and clay in order to achieve the desired fluid saturations. The mixture was then tamped into the combustion tube. Dry air combustion tube runs were performed keeping the conditions of saturation, air flux and injection pressure approximately the same during each run. The nature of the fuel formed and its impact on the combustion parameters were determined and compared with a control run – an experiment performed with no metallic additive. 30 refs., 33 figs., 6 tabs.

43795 (DOE/BC/14200–T1) **Statistically designed study of the variables and parameters of carbon dioxide equations of state.** Donohue, M.D.; Naiman, D.Q.; Jin, Gang; Loehe, J.R. Johns Hopkins Univ., Baltimore, MD (USA). 15 Apr 1990. 95p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89BC14200. Order Number DE90016196. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Carbon dioxide is used widely in enhanced oil recovery (EOR) processes to maximize the production of crude oil from aging and nearly depleted oil wells. Carbon dioxide also is encountered in many processes related to oil recovery. Therefore, accurate representations of the properties of carbon dioxide, and its mixtures with hydrocarbons, play a critical role in a number of enhanced oil recovery operations. One of the first tasks of this project is to select an equation of state to calculate the properties of carbon dioxide and its mixtures. In doing this, we have taken into account the equation's simplicity, accuracy, and reliability in representing phase behavior and thermodynamic properties of mixtures containing carbon dioxide with hydrocarbons at conditions relevant to enhanced oil recovery. We also have determined the thermodynamic properties that are important to enhanced oil recovery and the ranges of temperature, pressure and composition that are important. Twelve equations of state were chosen for preliminary studies to be evaluated against these criteria. All of these equations were tested for pure carbon dioxide and eleven were tested for pure alkanes and their mixtures with carbon dioxide. The ALS equation and the SED equation were selected for detailed statistical analysis. 51 refs., 37 figs., 13 tabs.

43796 (DOE/MC/21136–24) **Improvement of CO_2 flood performance: Fifth annual report for the period October 1, 1988–September 30, 1989.** Kovarik, F.S.; Heller, J.P. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center. Aug 1990. 386p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-84MC21136. Order Number DE90000254. Source: NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This research program is designed to improve oil recovery through carbon dioxide (CO_2) flooding. The program is composed of two main areas: Displacements of Pure and Impure CO_2, and CO_2 Mobility Control and Flow Heterogeneities. In Task Area I, work continued on assembling a comprehensive viscosity/density/composition database on CO_2/crude oil, CO_2synthetic oil, and lean gas/crude oil systems. A new procedure for estimating CO_2/crude oil viscosities applicable to both single-phase and equilibrium vapor- and liquid-phase mixtures from a single, internally consistent equation was developed using the database. A series of coreflood displacements concerning the effect of solution gas and free gas on the development of miscibility, using synthetic as well as crude oils, have been completed. Preliminary results from experiments using the new foam/coreflood apparatus to investigate flow through fractured rock systems are presented. Results were matched with the newly developed foam simulator. Foam mechanistic studies using glass micromodels at reservoir conditions have been conducted to compare the performances of SAG and WAG displacements as well as pregenerated vs. in-situ generated foams. Task II consists of research concerned with the reduced efficiency of floods caused by nonuniformity of flow in reservoirs. Research includes three separate areas: the mathematical description of rock heterogeneity, using the relatively new field of geostatistics, with special emphasis on the correlation of geostatistical parameters with calculated sweep efficiency; the history of tracer production from a well, as calculated from simulated displacements in synthetic random fields; and the measurement of small-scale heterogeneities in laboratory samples of reservoir rock, with an evaluation of their effect on flood results and scaling to the field. 149 refs., 121 figs., 24 tabs.

43797 (ER/C–90-03387) **Evaluate foams to improve oil recovery from heavy oil reservoirs: Final report.** Sarbar, M. (Esso Resources Canada, Calgary, AB (Canada)); Maini, B.; Goldman, J. Esso Resources Canada Ltd., Calgary, AB (Canada). Research Dept.; Petroleum Recovery Inst., Calgary, AB (Canada). Aug 1989. 87p. Contract EMR 23440-8-9020/01-SQ. (MICROLOG–90-03387). Source: PC Dept. of Industry, Science and Technology (ISTC), Library (CLIB), 235 Queen St., Ottawa, ON, CAN K1A 0H5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

An experimental investigation was carried out to develop a foam treatment for possible field application in a steam flood application. The aims of the study were: to evaluate several possible surfactants; and to provide data on the effect of several process parameters for the selected surfactant. Six different surfactants were evaluated in Ottawa sand cores. The increase in pressure drop across the core resulting from injection of the foaming surfactant with steam into the core containing steam flood residual oil was measured. All the surfactants except one caused large pressure drops. The main distinguishing features were the time required to achieve the high differential pressure and the minimum flow rate required to sustain the foam. In addition, the extent of surfactant losses due to adsorption and thermal degradation in the field were also considered. Chevron Chaser SD-1000 was selected as the most promising candidate based on the experimental results, available information on adsorption and thermal stability, surfactant cost and availability. The foam properties of Chevron Chaser SD-1000 were measured in Ottawa sand cores and in preserved reservoir cores. The effects of concentration, flow rates, steam quality and non-condensable gas were examined. 22 refs., 41 figs., 4 tabs.

43798 (EUR–12163) **Retention of surfactants in porous medium: Final report.** Duquerroix, J.P. (Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France)); Minssieux, L.; Bazin, B.; Defives, D. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 40p. Sponsored by Commission of the European Communities. Contract EN3C-0021-F. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

Reservoir rock retention of the chemical additives used in enhanced oil recovery processes heavily burden the economy of these processes. When surfactants (anionic and nonionic) are injected in shaly sand or argillaceous sandstone, the main cause of retention is the adsorption of these additives on the clays in the bored rocks. The goal of the research project reported here was to optimally limit adsorption effects in the implementation of these recovery processes. Research entailed the study of: reduced adsorption by modification of the surface condition of the adsorbing solid, use of a desorbing agent to dissolve the adsorbed surfactants to solution, and reduced adsorption by modification of the molecular structure of the surfactants. Since the adsorption of anionic surfactants on clays decreases when the pH increases, we propose conditioning the reservoir by injecting it with an alkaline agent solution before injecting a surfactant slug. Alkalinity consumption (alkaline slug wear) depends on two factors: H-Na(K) ion exchange with the rock, and rock dissolution. The porous media used in the study consisted of kaolin and sand, and we sought to represent the propagation of an alkaline solution in this type of medium after having studied the dissolution and ion exchange mechanisms on the separate minerals. Surfactants consisted of olefin sulfates, ethoxylated sulfonates, and sulfonated fatty acid esters. 25 figs., 8 tabs.

43799 (EUR–12164) **Flow in porous medium of two phases presenting a low interfacial tension: Final report.** Cuiec, L. (Groupement Europeen de Recherches Technologiques sur les Hydrocarbures (GERTH), 92 - Rueil-Malmaison (France)); Legait, B.; Moulu, J.C. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 79p. Sponsored by Commission of the European Communities. Contract EN3C-0020-F(CD). Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 7.50.

Physical mechanisms involved when injecting an aqueous solution of surfactant either by forced displacement during tertiary recovery or by spontaneous imbibition in the case of a fractured reservoir, are not very well known. During Phase I, the role of two physico-chemical phenomena (coalescence and interface rigidity between the two fluids) on low interfacial tension diphasic flows during a tertiary recovery have been evaluated. Two coalescence time measurement methods have been compared: emulsion decantation and the coalescence of two blobs in a spinning-drop tensiometer. Pairs of fluids with similar viscosities and interfacial tensions, but with coalescence times as different as possible, were selected. An oil phase flow model, in discontinuous form, has been established and successfully compared with the experimental results obtained both in micromodels and in porous media. Another interfacial phenomenon, interface rigidity, was studied by measuring displacement in porous media and capillaries, using a deep-channel viscometer. 15 refs., 49 figs., 3 tabs.

43800 (EUR–12286) **Study of oil-water-surfactant multiphase systems: Behaviour in porous media and optimization of oil recovery: Final report.** Langevin, D. (Ecole Normale Superieure, 75 - Paris (France). Lab. de Spectroscopie Hertzienne). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 17p. Sponsored by Commission of the European Communities. Contract EN3C-0018-F(CD). Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

The modelling of phase studies of oil-water-surfactant systems of enhanced petroleum recovery is described. 10 refs., 3 figs., 4 tabs. (CBS)

43801 (NIPER–479-Vol.2) **National Institute for Petroleum and Energy Research quarterly technical report, April 1–June 30, 1990: Volume 2, Energy production research.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jul 1990. 95p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90015849. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Research programs from NIPER are presented in the following areas: reservoir assessment and characterization, TORIS research support, development of improved microbial flooding methods, development

of improved alkaline flooding methods, development of improved mobility-control methods, gas-miscible displacement, development of improved immiscible gas displacement methodology, three-phase relative permeability, thermal processes for light oil recovery, thermal processes for heavy oil recovery, imaging techniques applied to the study of fluids in porous media, microbial enhanced waterflooding field project, technical analysis for underground injection control, development of an inflow performance relationship (IPR) for a slanted/horizontal well under solution gas drive, Phase 1 – developing a reservoir data base, EOR incentive projects survey, and feasibility study of heavy oil recovery in the midcontinent region.

43802 (NIPER–481) **National Institute for Petroleum and Energy Research monthly progress report for July 1990.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). 20 Aug 1990. 45p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90015848. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research programs from NIPER are briefly described in the following areas: Reservoir Assessment and Characterization, TORIS Research Support, Development of Improved Microbial Flooding Methods, Development of Improved Surfactant Flooding Methods, Development of Improved Alkaline Flooding Methods, Development of Improved Mobility-Control Methods, Gas Miscible Displacement, Development of Methods To Improve Mobility Control and Sweep Efficiency in Gas Flooding, Three-Phase Relative Permeability, Thermal Processes for Light Oil Recovery, Thermal Processes for Heavy Oil Recovery, Imaging Techniques Applied to the Study of Fluids in Porous Media, Development of Analytical Methodology for Analysis of Heavy Crudes, Thermochemistry and Thermophysical Properties of Organic Nitrogen- and Diheteroatom-Containing Compounds, Microbial-Enhanced Waterflooding Field Project, Technical Analysis for Underground Injection Control, Phase 1- Reservoir Data Base Development, EOR Incentive Projects Survey, Feasibility Study of Heavy Oil Recovery in the Midcontinent Region, and IPRs for Slanted and Horizontal Wells Producing From Heterogeneous Reservoirs.

43803 (PRI–90-03385) **Study of fines migration in heavy oil reservoirs: Final report.** Nasr-El-Din, H.; Coskuner, G.; Maini, B. Petroleum Recovery Inst., Calgary, AB (Canada). Jul 1989. 120p. Contract EMR 23440-8-9018/01-SQ. (MICROLOG–90-03385). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A review of the literature on fines migration in porous media was conducted. As a result, various factors which affect fines migration and their relative importance in heavy oil reservoir were identified. A corrosion resistant linear core displacement apparatus for fines migration experiments was built. The equipment was capable of handling unconsolidated cores (approximately 4 cm indiameter and 15 cm long), high pressures (up to 20 megapascals) and high temperatures (up to 250°C). Representative core samples from two different heavy oil reservoirs in Alberta were analyzed to determine the type, amount, morphology and location of fines with respect to their pore system. These reservoirs were selected from those with permeability damage problems. Various petrographic tests were conducted on each reservoir core sample. A method for extraction of cores, which minimizes the permeability, wettability, viscosity, and ionic strength of the injected fluid on permeability damage was examined. The following trends were observed: permeability damage due to mechanical fines migration was significant for low-permeability reservoir cores but not for high-permeability cores. The damage due to chemical fines migration was significant for all cores studied. Injection of a non-wetting fluid did not cause any fines migration or permeability damage. 114 refs., 56 figs., 1 tab.

43804 (STA–89-04483) **Evaluation of heavy oil recovery process using a novel combination of injectants: Final report.** Azzam, M.I.S. Sheridan Technical Associates, Inc., Oakville, ON (Canada). Feb 1989. 129p. (MICROLOG–89-04483). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A study of the displacement of heavy oil by a combination of hot water and gas has been undertaken, based on bench-scale, non-scaled, core displacement experiments. Two heavy oils from Alberta and Saskatchewan were used. The effect of a range of operating variables (injection temperature, water injection rate, gas injection rate, and back pressure) and interactic . (oil/gas/permeability interactions and oil/additive/connate water salt concentration) was investigated. The potential roles of a soluble gas and of interfacial additives petroleum sulfonate additive were also examined. The hot water-gas drive process was ultimately evaluated by comparison with steamflood reference experiments. An oil recovery enhancement index was defined, and consistently used in the statistical analysis of the experimental results. Of the operating variables, only injection temperature increase had the expected effect of increasing oil recovery (by the hot water-gas process). Fluid injection rates and back pressure had statistically insignificant effects on the process. Analysis of the results shows a significant advantage to using carbon dioxide, over nitrogen, in the hot water/gas drive process. Using interfacial additives, particularly NaOH, proved to have potential merit in connection with the process. The results suggest that heavy oil recovery by a combinatin of hot water and gas displacement is comparable to recovery using a steam drive (60-75% of original oil saturation, under the present set of experimental conditions). The study points to the controlling factors, range of sensitivities, and areas of potential improvements of the hot water/gas drive. 53 refs., 177 figs., 63 tabs.

43805 **Light oil steamdrive pilot test at NPR-1, Elk Hills, California.** Gangle, F.J. (U.S. Dept. of Energy (US)); Weyland, G.V.; Lassiter, J.P.; Veith, E.J. pp. 177-186 of Proceedings of the SPE California regional meeting. Society of Petroleum Engineers, Richardson, TX (USA) (1990). (CONF-9004156–: 1990 Society of Petroleum Engineers (SPE) California regional meeting, Ventura, CA (USA), 4-6 Apr 1990).

Technical Paper SPE 20032.

A steamdrive pilot is under evaluation on a light oil Pliocene reservoir at the Naval Petroleum Reserve No. 1 (NPR-1), the Elk Hills field in Kern County, California. The steamdrive process is explored from both reservoir and production perspectives. The authors describe the approach taken design acid cleanup treatments.

43806 **Flow and displacement of Bingham non-Newtonian fluids in porous media.** Wu, Y.S. (Lawrence Berkeley Lab., Berkeley,CA (US)); Pruess, K.; Witherspoon, P.A. pp. 329-352 of Proceedings of the SPE California regional meeting. Society of Petroleum Engineers, Richardson, TX (USA) (1990). (CONF-9004156–: 1990 Society of Petroleum Engineers (SPE) California regional meeting, Ventura, CA (USA), 4-6 Apr 1990).

Technical Paper SPE 20051.

Numerous steam displacement patterns have been converted to hot waterflood pilots in the Kern River field. This test program was designed to evaluate hot water injection as a viable recovery mechanism in a post steamflood reservoir. Response to hot water injection was typified by a decline in oil production and a corresponding increase in water production. Investigation into the reservoir rock and fluid properties indicated that a mobility ratio of 3.8 in combination with a highly permeable sand and steam desaturated area would not allow the formation of an effective immiscible displacement bank. The monitoring program demonstrated that oil resaturation occurred in areas where the injection water filled the steam desaturated zone. Temperature data from observation wells showed that hot water was ineffective at transferring heat to the reservoir.

0204 Processing

Refer also to citation(s) 43663, 43828, 44275

43807 (ENEA-RT-COMB–89-17) **Wet oxidation of high chlorine content polychlorobiphenyls.** Nardi, L. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Dec 1989. 67p. (In Italian). (RT/COMB–89-17). Order Number DE90514469. Source: NTIS (US Sales Only), PC A04/MF A01.

This paper reports on studies of the kinetics of wet oxidation of biphenyl, polychlorobiphenyls (PCBs contained in a sample of Askarel oil for transformers) and of polychlorobenzenes, by reaction with concentrated hydrogen peroxide aqueous solutions catalysed by ferrous sulphate. Two approaches were tried: (a) reaction in heterogeneous media, using internal standards for quantitative evaluation, and (b) reaction in homogeneous media, using co-solvents (namely acetic acid, acetic anhydride and N,N-dymethylformamide) and the external standard method for quantification. The above mentioned organic compounds were decomposed by both wet-oxidation methods. PCBs were degraded from 90 to 100%, by hydrogen-peroxide in homogeneous media. The results of homogeneous wet oxidation pointed out that all the co-solvents used can work quite well, with minor differences among them. The initial concentration levels of PCBs appeared to be critical parameters: in fact, too high values bring about separation of aqueous and organic phases during the wet-oxidation process, making homogeneous treatment ineffective as well.

43808 (IFP–37-059) **Use of additives for improvement of thermal transformation of heavy petroleum fractions.** Thomas, M. Lyon-1 Univ., 69 - Villeurbanne (France). Feb 1989. 261p. (In French). Order Number DE90514536. Source: NTIS (US Sales Only), PC A12/MF A01.

Thermal conversion of heavy fractions is generally accompanied by production of coke and gases and a low quality product. Additional use of a hydrogen donor and of a sulphur compound (thiol, disulfide, sulfoxide) yields a high liquid fraction ratio and a better quality. Analysis of fractions obtained confirm the synergism of these two additive types. Use of a polyaromatic compound like pyrene controls coke formation. Reactivity of these additives is examined with different structures of heavy fractions.

0205 Products and By-Products

Refer also to citation(s) 44524, 44994

43809 (EEA–89-05127) **The conversion of gas oil in a rapid cracking process using cracking catalyst and silica sand heat carriers: Final report.** Freel, B.A. (Ensyn Engineering Associates, Inc., Gloucester, ON (Canada)); Graham, R.G. Ensyn Engineering Associates, Inc., Ottawa, ON (Canada). 27 Mar 1989. 72p. CONTRACT EMR 23440-8-9028/01-SQ. (MICROLOG–89-05127). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A preliminary investigation of the conversion of gas oil to chemical intermediates and light transportation fuels was carried out in a pilot plant, rate nominally at 1 bbl/d and equipped with a novel reactor system to accomplish very fast heat transfer and short residence times over a broad range of reaction temperatures. Six experiments included a non-catalytic heat carrier (silica sand) to transfer heat to the reactor systems. In three other experiments a catalytic heat carrier (an aluminosilicate cracking catalyst) was used. Complete mass balance procedures were carried out during all of the experiments in order to verify the estimates of the product yields. The highest non-optimized gasoline yield was 16.2% by mass of the gas oil feedstock. This yield occurred using the catalytic heat carrier at a reaction temperature of 575°C and a residence time of 500 ms. The maximum (non-optimized) gasoline yield using a non-catalytic heat carrier was 15.1%, and occurred at a reaction temperature of 840°C and a residence time of 340 ms. The use of catalyst had a dramatic effect on gasoline yields for a given reaction temperature. The highest (non-optimized) yield of the fraction boiling in the decant range was 25.8%, using a catalyst heat carrier at 670°C and 390 ms. The highest olefin (total unsaturated gases) yield was 30%, by mass, of the gas oil feedstock, and was produced using a no-catalytic heat carrier at 770°C and 330 ms. The use of catalyst had very little effect on olefin yields. In general, the coke yields were relatively low. Maximum coke yields are observed when maximum gasoline yields occur. 4 refs., 4 figs., 11 tabs.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 43776, 43787, 43788, 43789, 44384, 44447, 44448, 44461, 44462, 44601

43810 (CEC–90015481) **Quarterly oil report, third quarter 1989.** Trenschel, D. (ed.). California Energy Resources Conservation and Development Commission, Sacramento, CA (USA). Apr 1990. 48p. Sponsored by California Energy Commission. (P–300-90-001). Source: OSTI; California Energy Commission, 1516 Ninth Street-MS 13, Sacramento, CA 95814.

This report describes the California petroleum fuels market activity in the following areas: refinery receipts and operations, imports and exports, petroleum fuels supplied, and prices. 10 figs., 6 tabs. (CBS)

43811 (CERI–90-01031) **The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.** Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. vp. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This document includes the keynote addresses and panel presentations at the conference. Keynote addresses covered the state of the world oil market, the U.S. national energy strategy, and OPEC oil in the 1990s. The panel presentations covered world oil market perspectives; international gas markets; downstream investments in Europe, U.S. and Canada; North American gas markets,particularly Ontario and California as well as an update on the Iroquois pipeline and other regional pipeline constraints and developments; and exploration and development, particularly in Columbia, Australia and Canada. Separate abstracts have been prepared for 21 papers from this conference.

43812 (CERI–90-01031, pp. 1-39, Section 6) **Colombian perspective in the petroleum industry.** Amorocho, E. (Refining and Transportation, Empresa Colobiana de Petroleos, Bogota (Colombia)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper describes the petroleum industry in Colombia, its organization and the contract systems used to promote exploration and exploitation by both domestic and foreign companies. The state plan, which gives first priority to exploration, is described. The various pipelines, the consumption of white products, and the construction of a new refinery are other elements, as are the production of natural gas and the development of R&D. 9 tabs., 12 figs.

43813 (CERI–90-01031, pp. 1-5, Section 6) **Oil and gas exploration and development in the 1990's, the Canadian scene.** Merki, P.J. (Shell Canada Ltd., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper discusses the perceptions oil companies have with regard to pricing of oil, gas, bitumen and sulphur; the resource

base; regulatory and fiscal systems; political factors and environmental concerns potentially impacting the business; application of new technology and related cost; and the economics of all these factors.

43814 (CERI–90-01031, pp. 1-5, Section 6) **The strategy of the U.S. producer.** McColgin, J.D. (Conoco Canada Ltd., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper consists of a discussion of strategy of the large U.S. multinational producer, the stated financial goals and the unstated goal of self-continuation. Strategies to meet these goals include a re-emphasis on vertical integration, divestment of non-oil and gas businesses, geographical diversification, consolidation of operations, maintenance or increase in the reserve base, and focusing on large fields.

43815 (CERI–90-01031, pp. 1-16, Section 4) **Future investment in the downstream in Canada.** Crandall, G.R. (Hycarb Engineering Ltd., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper presents the investment outlook for the Canadian downstream oil and gas industries, highlighting developments and projects that are currently underway or are in the planning stages. The discussion is limited to the petroleum refining and marketing industry, natural gas processing, natural gas liquids, and petrochemical developments. Since petrochemical prices have fallen considerably over the past 2 years, some of the petrochemical investments might be deferred. However, the sponsors of the projects are major companies, and would be expected to take a long-term approach to such developments. The Canada-U.S. Free Trade Agreement should be a major factor in encouraging some of these developments by making Canada a favourable place to invest. 2 figs.

43816 (CERI–90-01031, pp. 1-21, Section 4) **Downstream prospects for the U.S. petroleum industry.** Picchi, B.J. (Salomon Brothers Inc., New York, NY (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The 1980s were a decade of restructuring for the petroleum industry, in which refining capacity was rationalized and a number of small refineries were shut down. A refining/marketing profitability analysis was conducted by Salomon on 21 major oil firms. The review consisted of a profitability analysis and an operating analysis. The 5-year financial analysis concentrated on operating earnings, operating earnings per barrel of product sales, net income return on identifiable downstream assets, and cash flow return on identifiable downstream assets. The paper discusses two of the factors leading to financial success: market integration and processing sophistication. The conclusions are that the major factors for the future health of the refining sector are product demand, environmental issues, plant capacity expansion and the invovement of oil exporting countries in product manufacturing and marketing. 7 tabs., 11 figs.

43817 (CERI–90-01031, pp. 1-8, Section 4) **The prospects for downstream investment in the European Community.** Langridge, G.H. (Commission of the European Communities, Brussels (Belgium)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper briefly reviews conditions in the downstream oil and gas industries of the European Community since 1973, assesses the present situation, and considers the prospects in the coming years, particularly in consumption, investment and profitability. According to a study of energy use in Europe by the Commission, no further large scale substitution of oil by competing energy sources is expected to occur before 2010 and a significant (16%) rise in energy consumption from 1987-95 is expected. After 1995, natural gas is assumed to increase its market share at the expense of oil. Profitability in the refining industry is likely to continue, particularly from the added value of a growing proportion of high specification products and from the tight supply situation for them. 4 tabs., 1 fig.

43818 (CERI–90-01031, pp. 1-8, Section 2) **Certain considerations affecting the world oil market.** Conant, M.A. (Canant and Associates, Ltd., Washington, D.C. (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper discusses some of the considerations affecting the world oil market, including the reliability of the data used in energy projections, particularly that from the OPEC countries; the question of OPEC unity; possible government intervention in domestic prices; and the question of conservation and alternative fuels. In at least the OECD countries, oil demand will depend on the emphasis on reduction of emissions, which focuses largely on improvements in transportation fuels and in power generation. In areas where natural gas is available in increasing volumes and where research and development into both gas and coal offers an increasingly attractive alternative, oil demand may undergo significant changes. 2 tabs.

43819 (CERI–90-01031, pp. 1-5, Section 2) **Medium term supply and demand outlook.** Ramirez, N.G. (Petroleos de Venezuela, S.A., Caracas (Venezuela)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper discusses the medium term supply and demand outlook, covering the growth of petroleum demand and production by both OPEC and non-OPEC countries, particularly that of Venezuela. The paper assumes an average world economic growth rate over the next few years of 2.5%, with oil demand at 2.0%, paced by the Far East where the majority of growth is occurring. For OPEC to maintain production capacity to meet this demand,

enormous amounts of capital must be raised to finance the capacity additions in the production and refining sector. Since 1983, Venezuela has moved into downstream integration in Europe, making it more like an integrated international oil company with its own production, multi-country refining and marketing system.

43820 (CERI–90-01031, pp. 1-26, Section 2) **World enegy prospects: An overview.** Kyle, J.F (Exxon Corp., New York, NY (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper provides a brief summary of the long-term energy outlook to 2010, as well as the principal near-term uncertainties in the world oil market. The paper begins with economic projections, leading to substantial absolute growth in energy markets. The relationship between economic growth and energy use is explored next, leading to prediction of a rise in oil and gas prices and various pressures to achieve energy efficiency for environmental reasons. The paper then discusses energy demand by region and fuel; liquids demand by region and world liquids production; potential demand for OPEC crude oil; and near-term crude requirements. To conclude, the principal uncertainties are identified as the rate of growth in demand, the duration of key countries' market share /volume orientation, and the pace of OPEC capacity expansions. 4 tabs., 5 figs.

43821 (CERI–90-01031, pp. 1-15, Section 1) **The state of the world oil market.** Lumsden, G.Q. Jr. (Oil Market Development, International Energy Agency, Paris (France)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910432–: 22. annual Propane Gas Association of Canada Transportation symposium, Calgary (Canada), 25-26 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper presents an overview of the politico-economic state of the world oil market, dealing first with the short-term aspects, then the long-term aspects. In the short-term, OPEC will be willing to adjust and increase their output to meet the requirements of the market, although that market will not necessarily have the type of buyer/seller balance which prevailed for the last half-decade. In the long-term, demand and price of crude oil and petroleum products will rise consistently, sustained by steady economic growth rates in the industrialized world and still higher ones in the developing world. Oil will remain the principal component of world primary energy requirements, but while the volume of its use will increase, its percentage share of total energy consumption will decline. The economic growth and energy intensities of developing countries may complicate global environmental and energy supply problems. The share of OECD countries in energy consumption vs. the rest of the world will pass from somewhat over to somewhat under 50% some time during the 1990s, a change in the global balance which is fundamental to understanding the evolution of energy in the coming years.

43822 (CERI–90-01036) **[The sixth annual international oil and gas markets conference].** Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. vp. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This document includes the papers presented at the conference, covering supply and demand, regulatory aspects, financing, and market development of oil and natural gas in Canada, the U.S., Europe, the Middle East, China, Brazil and the Pacific Rim countries. Separate abstracts have been prepared for 20 papers.

43823 (CERI–90-01036, pp. 1-19, Paper 23) **Financing for the oil and gas industry: Europe.** Wilson, T.M. (Orion Royal Bank Ltd., London (UK)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

Against the backdrop of the oil industry's exploration and development plans and the rapidly changing international financial markets, this paper adresses the questions of whether there is sufficient funding available for Western European development in the future; whether the London market will be a source of debt and equity for the industry beyond Europe; and the impact of the L8 billion sale of the U.K. government's shares in BP on financial markets. The paper concludes that in Europe, debt and equity finance will not be a practical limitation to the industry as a whole, although selective availability is leading to consolidations/reorganisation, revaluation of assets and corporations and lower debt/equity ratios. In addition, there are shifts towards management teams with proven financing capability as well as technical and general management strengths. 9 figs.

43824 (CERI–90-01036, pp. 1-11, Paper 18) **The world oil market, Europe: Current situation and medium-term outlook.** Smart, I. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper describes the current oil market in the OECD countries, including increased use of middle of the barrel products such as gasoline and diesel fuel, the effects of prices on the market, demand volatility, imports, and supply. Western European oil production confronts not only a prospect of overall decline in quantity during the 1990s, as the oldest and largest North Sea fields are depleted, but also increasing problems of location, quality and marketability. The medium-term will be shaped by the interaction of world oil prices and their impact on Europe's indigenous development of oil resources and on the rate at which social change and interfuel substitution alter the qualitative pattern of regional oil demand. Concern about the environmental effects of burning hydrocarbons is also likely to play a larger role in the marketplace.

43825 (CERI–90-01036, pp. 1-21, Paper 17) **Oil and gas supply development: The Brazilian perspective.** Silva, O. (Petroles Brasileiro S.A., Rio de Janeiro (Brazil)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

In Brazil, the state-controlled company Petrobras is responsible for the supply of petroleum and oil products throughout the nation. At the present time, 34 years after its founding, the company has diversified its activities to include petrochemistry, distribution, fertilizers and mining. This paper describes the company's subsidiaries, its exploration and production, the role of offshore prospecting, research, refining, and transportation. An organizational chart is included. 1 tabs., 12 figs.

43826 (CERI–90-01036, pp. 1-19, Paper 16) **European refining outlook.** Santamaria, J. (Petroleos del Mediterraneo, S.A., Madrid (Spain)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper examines the changes that have occurred in the refining industry in Europe after 1987, the changes that are now underway, and the implications for the future. The paper reviews the demand, volume, structure and product quality of oil; the capacity and structure of the refining industry; and the economics of refining, including refinery margins and outside factors. The review covers the 12 members of the European Community, with data adjusted to include the newer members. The paper concludes that the integrated companies have run their refineries in a non-integrated way as part of the internal logic of a system based on separate cost centres. However, along the way this system may have lost some of the uniting thread that gives coherence to its actions. This leads to the conclusion that the refining industry in Europe faces challenges to both improve its efficiency in energy use, cost control and adequacy of installations, and to become more prominent and flexible in the supply system. 5 tabs., 1 fig.

43827 (CERI–90-01036, pp. 1-9, Paper 9) **Petroleum industry in China: Current situation and medium-term outlook.** Lan Tianfang (China Energy Research Society, Peking (China)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper gives an overview of the production of crude oil in China, as well as offshore exploration in cooperation with foreign companies, the capacity of the downstream sector, and its export capacity. Production appears to have peaked and therefore export capacity will not expand further. Further modernization will be undertaken, with the emphasis on the enormous domestic market. 3 tabs., 2 figs.

43828 (CERI–90-01036, pp. 1-6, Paper 21) **Review and outlook for U.S. refiners.** Turner, M.M. (Turner, Mason and Co. Dallas, Tx (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This review of the U.S. refining industry covers conditions and production from the 1960s to the present. The paper discusses the demand for gasoline and the trend for higher octanes, the economic aspects of the business, and the impacts of proposed reductions in gasoline Reid vapor pressure specifications. The crux of the overall outlook for improvement in refiners' margins and economic performance for the next few years is based on an assessment of the industry's gasoline manufacturing capability. The current projection indicates that without capital additions and other operational improvement programs, U.S. refiners will have inadequate gasoline manufacturing capability to meet motorists' demands in 1990. Since there is also no great prospect for a flood of imports, U.S. refiners will have their best opportunity in years for stable profits and the chance to respond and plan for changes in an orderly manner.

43829 (CERI–90-01036, pp. 1-16, Paper 10) **Energy investments and the Pacific Rim LDCs [less developed countries].** Malhotra, A.K. (World Bank, Washington, D.C. (USA)); McCarthy, E.D. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

The precipitous decline of crude oil prices on international markets in recent months has highlighted the symbiotic relationship between petroleum and the world economy. The world oil price has had an impact on the world economy, the petroleum industry, and on the energy policies in the developing countries. This paper considers some of the difficulties now presented in the Pacific Rim area, particularly China, Korea, Indonesia, Malaysia, Thailand and the Philippines. Their future energy outlook is considered, as well as policy issues and the role of World Bank in the area. The World Bank plans to continue its efforts in Asian countries, with a special emphasis on gas. 5 tabs.

43830 (DOE/EIA–0340(89)/2) **Petroleum supply annual 1989: Volume 2.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 7 Jun 1990. 577p. Sponsored by U.S. DOE Management & Administration. Order Number DE90016012. Source: NTIS, PC A25/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Supply Annual (PSA) contains information on the supply and disposition of crude oil and petroleum products. The publication reflects data that were collected from the petroleum industry during 1989 through annual and monthly surveys. The PSA is divided into two volumes. The first volume contains three sections, Summary Statistics, Detailed Statistics, and Refinery Capacity, each with final annual data. The second volume contains final statistics for each month of 1989, and replaces data previously published in the Petroleum Supply Monthly (PSM). The tables in Volumes 1 and 2 are similarly numbered to facilitate comparison between them. Explanatory Notes, located at the end of this publication, present information describing data collection, sources, estimation methodology, data quality control procedures, modifications to reporting requirements and interpretation of tables. Industry terminology and product definitions are listed alphabetically in the Glossary.

43831 (DOE/EIA–0380(90/05)) **Petroleum marketing monthly, May 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 2 Aug 1990. 185p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE90015522. Source: NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oils and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs., 49 tabs.

43832 (DOE/EIA–0520(90/07)) **International petroleum statistics report, July 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 27 Jul 1990. 38p. Sponsored by U.S. DOE Management & Administration. Order Number DE90016010. Source: NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports and stocks. The report has three sections. Section 1 contains time series on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1973, and monthly data for the most recent two years. Section 2 presents an

oil supply/consumption balance for the market economies (i.e. non-communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data beginning in 1982, and quarterly data for the most recent two years. 8 refs., 23 tabs.

43833 (PB–90-224965/XAB) **Petroleum cooperatives, 1988. Research report.** Eversull, E.E.; Dunn, J.R. Agricultural Cooperative Service, Washington, DC (USA). May 1990. 25p. (ACS/RR–94). Source: NTIS, PC A03/MF A01.

See also PB–85-209997.

The report examines the vital role that agricultural cooperatives perform in providing petroleum products to farmers and for rural America. All aspects of cooperative involvement are documented, from crude oil well exploration to the wholesale and retail distribution of refined petroleum products. Nineteen regional and interregional cooperatives responded to a survey asking detailed information on their petroleum operations. Cooperatives continue to be a very important supplier of petroleum products for farm production, having a 39 percent market share in 1988.

43834 (PB–90-233644/XAB) **Minerals yearbook: The mineral industry of Mexico. 1988 international review.** Machamer, J.F. Bureau of Mines, Washington, DC (USA). 1988. 30p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

Mexico is one of the major mineral-producing countries in the world, continuing in 1988 a role that the nation had assumed since the first European settlement of the Western Hemisphere. With respect to nonfuel minerals, Mexico was the world's leading producer of bismuth and silver; was among the top 5 producers of barite, fluorspar, graphite, molybdenum, and strontium; and was among the top 10 producers of antimony, white arsenic, cadmium, copper, lead, manganese, mercury, salt, selenium, sulfur, and zinc. In the mineral fuels sector, Mexico was the sixth largest producer of crude oil and ranked eighth in terms of proven oil reserves. In addition, Mexico was the largest foreign supplier of crude oil and cement to the United States. Topics discussed in the report include: Government policies and programs; Production; Trade; Commodity review–Metals, Industrial minerals, and Mineral fuels.

43835 (PB–90-236878/XAB) **Census of manufactures, 1987. Industry series: Petroleum and coal products. Industries 2911, 2951, 2952, 2992, and 2999.** Bureau of the Census, Washington, DC (USA). Apr 1990. 55p. (MC–87-I-29A). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs. See also PB–90-236860.

The report shows 1987 Census of Manufactures statistics for establishments classified in each of the following industries: Petroleum Refining; Asphalt Paving Mixtures and Blocks; Asphalt Felts and Coatings; Lubricating Oils and Greases; and Petroleum and Coal Products, N.E.C. The industry statistics (employment, payroll, cost of materials, value of shipments, inventories, etc.) are reported for each establishment as a whole. Aggregates of such data for an industry reflect not only the primary activities of the establishment but also their activities in the manufacture of secondary products as well as their miscellaneous activities (contract work on materials owned by others, repair work, etc.).

43836 **The replacement cost integration program: An engineering-economic model of oil supply.** Reister, D.B. (Oak Ridge National Lab., TN (USA)). pp. 89-98 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). DOE Contract AC05-84OR21400. (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper addresses the development of the Replacement Cost Integration Program (RCIP). RCIP forecasts the discovery and production of crude oil in 31 regions of the United States (the onshore lower 48 states have 6 regions, the offshore lower 48 states have 10 regions, and Alaska has 15 regions). In addition to responding to changes in expected oil prices, RCIP is designed to forecast the impact of changes in the outer continental shelf (OCS) oil and gas leasing program, in estimates of undiscovered crude oil, and in federal income tax policy.

43837 **Taxation effects on the competitiveness of U.S. oil and gas investments.** Flaim, S.J. (Argonne National Lab., IL (USA)); Hemphill, R.C.; Gordon, R.G. pp. 65-76 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper presents differing points of view on oil and gas taxes. The authors apply several concepts that might add insight into the resource management debate.

43838 **A review of energy forecasts: What have we learned.** Shealy, M.T. (Decision Focus, Inc., Los Altos, CA (USA)). pp. 353-362 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper reviews a series of Department of Energy (DOE) long-term forecasts for non-OPEC oil supply, free world oil demand, and crude oil price. The analysis begins by examining the evolution of the base-case supply, demand, and price forecasts for 1990. The demand forecasts are then corrected for errors in exogenous inputs. The results suggest that the demand model was calibrated high in the early years, which leads to a discussion of sources of model bias. Finally, the behavior of the DOE low, middle and high price forecasts is reviewed. Suggestions are made for improving the representation of price uncertainty.

0208 Waste Management

Refer also to citation(s) 43903, 44209

0209 Environmental Aspects

Refer also to citation(s) 44395, 44410, 45345, 45366, 45398, 45408, 45413

43839 (GAO/RCED–90-21) **Air pollution EPA'S efforts to control gasoline vapors from motor vehicles.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 40p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report examines ozone, often called smog, which is a respiratory irritant, and long-term exposure may cause permanent lung damage. Attempts by EPA to reduce gasoline vapors, a major contributor to ozone, by requiring refiners to lower the volatility (evaporation rate) of gasoline sold during the summer months when most high ozone levels occur and auto manufacturers to install vapor recovery equipment (onboard controls) on motor vehicles. Beginning in 1989 (Phase I), the maximum volatility of gasoline sold during the summer would fall to 10.5 pounds per square inch and beginning in 1992 (Phase II), the maximum volatility would fall to 9.0 pounds per square inch. EPA has not yet acted on Phase II reductions because it disagrees with the Department of Transportation on the dangers of adding onboard controls to vehicles. DOT believes the onboard controls may pose an increased risk of fire during crashes. In this report's view, the Stage II controls are a practical and feasible way to control refueling vapors and that onboard controls may well surpass the effectiveness of Phase II controls and therefore should not be abandoned as a way to reduce gasoline vapors.

43840 (GAO/RCED–9044) **Coast Guard: Adequacy of preparation and response to Exxon Valdez oil spill.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 24p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report believes the response to the Exxon Valdez grounding was clearly inadequate in containing and recovering the spilled oil. No one had realistically prepared for a spill of that size in Prince William Sound, and a similar lack of preparedness may well exist

elsewhere in the United States. According to this report, an important reason for this national unpreparedness is that no single designated leader or authority is responsible for ensuring the adequacy of preparations. Concerns have also surfaced about current oil spill containment technology and about the risks associated with water transportation of hazardous cargo. This report views improvement of prevention measures as a priority.

43841 (OCS/EIS/EA/MMS–90-0005) **5-year Outer Continental Shelf oil and gas leasing program, mid-1987 to mid-1992: Supplemental environmental impact statement: Final report.** Minerals Management Service, Herndon, VA (USA). Aug 1990. 366p. Sponsored by U.S. Department of the Interior. Source: OSTI; US Department of the Interior, Minerals Management Service, 381 Elden Street, Herndon, VA 22070.

This final document supplements the final environmental impact statement prepared for the 5-year (Mid-1991) Outer Continental Shelf (OCS) oil and gas leasing schedule. This document analyzes the cumulative impacts of OCS development on migratory species whose migration routes traverse more than one planning area in the Alaska and Pacific Regions. The analysis is based on the court's premise that the Secretary did not consider the effects of simultaneous inter-regional development on migratory species. It also describes and incorporates into the analysis the OCS oil and gas activities and non-OCS activities along those migration routes. The overall cumulative impacts on migratory species could be caused by oil and gas activities, oil spills, effluent discharges, noise (aircraft and vessel traffic and human disturbances), loss of habitat, subsistence and sport hunting, and natural perturbations. Coastal States which are considered in the analysis are: Alaska, Washington, Oregon, and California.

43842 (PB–90-184094/XAB) **Puerto Rico workshop on land-based sources of marine pollution in the wider Caribbean region. Held in San Huan, Puerto Rico on August 7-9, 1989. US man and the biosphere program.** Department of State, Washington, DC (USA). Bureau of Oceans and International Environmental and Scientific Affairs. Apr 1990. 34p. Source: NTIS, PC A03/MF A01.

See also PB–87-115580.

The participants in the conference met August 7-9, 1989, in San Juan, Puerto Rico. The participants divided the report into four major sections, each succeeding section relying for inputs from the preceding sections. They are: inventory of land-based sources of marine pollution. The inventory, divided into point sources and nonpoint sources of pollutants, establishes the baseline data for dealing with marine pollution, impact of land-based sources of marine pollution. The extent of the impact of pollutants on the ecological and economic life dependent on the marine environment calls for scientific analyses involving the nature of the polluting substances as well as that of the receiving marine areas, development of tropical water quality and effluent standards. Tropical water quality criteria and standards provide essential analytical links between the use of marine waters and the control of marine pollution, and marine pollution control strategy. The means for managing land-based sources of marine pollution can be divided into utilizing marine water quality standards, effluent standards, environmental planning, and best management practices. The writers of the report dealt with only man-made pollution, which is distinct from natural pollution such as oil seepage through ancient fissures in the seabed.

43843 (PB–90-228958/XAB) **Health assessment for New Hanover County Burn Pit, Wilmington, New Hanover County, North Carolina, Region 4. CERCLIS No. NCD981021157. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 May 1990. 13p. Source: NTIS, PC A03/MF A01.

The New Hanover County Burn Pit, Wilmington, New Hanover County, North Carolina, has been proposed for the National Priorities List by the Environmental Protection Agency (EPA). The burn pit is part of an active airport and was used from 1968-1979 for fire-training exercises. Aviation fuel, waste oil, and petroleum tank bottoms were burned and extinguished with water, carbon dioxide, or dry chemicals. Samples from the pit and soil adjacent to the pit, where pit contents were drained, showed the presence of heavy metals, polynuclear aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). Investigation of the site has been limited to the pit and surrounding soil. Groundwater is close to land surface in the area and may be affected. Groundwater is used for domestic purposes within a 3-mile radius of the site. Based on the available information, the site is considered to be of potential public health concern because of the risk to human health caused by the possibility of exposure to hazardous substances.

43844 (PB–90-228966/XAB) **Health assessment for Tosco Corporation, Spokane, Spokane County, Washington, Region 10. CERCLIS No. WAD000641548. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 May 1990. 14p. Source: NTIS, PC A03/MF A01.

The Tosco Corporation site was proposed for the National Priorities List in Update 7. The site is located 1.5 miles north of Spokane in eastern Washington. Industrial activities, which have been conducted at the site since the 1920s, have resulted in contamination of environmental media with petroleum-derived chemicals. High concentrations of volatile aromatic compounds and polyaromatic hydrocarbons were detected in on-site soils and groundwater. The migration of contaminated groundwater from the site has impacted off-site private wells, but, to date, there is no evidence that any public water supply wells have been impacted. The use of contaminated water for potable or nonpotable purposes could result in exposures of potential health concern by the ingestion, inhalation, or dermal absorption. Human contact with oil wastes in the former lagoon area could result in exposures of health concern by the ingestion, dermal absorption, or inhalation of contaminants. Such exposures would be most likely to occur during excavations in the lagoon area.

43845 (PB–90-231689/XAB) **Invertebrate communities of small streams in northeastern Wyoming. Water Resources Investigation.** Peterson, D.A. Geological Survey, Cheyenne, WY (USA). Water Resources Div. 1990. 53p. (USGS-WRI–85-4287). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

Invertebrate communities of small streams in an energy-mineral-development area, the Powder River structural basin of northeastern Wyoming, were studied during 1980-81. The purpose of the report is to describe the benthic invertebrate communities of streams in an energy-mineral-development area, in a manner useful to regulatory agencies, industry, and other groups.

43846 (PB–90-232539/XAB) **Blackleaf environmental impact statement. Draft report.** Bureau of Land Management, Lewistown, MT (USA). Lewistown District Office. Mar 1990. 285p. (BLM/MT/ES–90/003/4111). Source: NTIS, PC A13/MF A02.

Also available from Supt. of Docs.

The draft environmental impact statement (EIS) analyzes the impacts of full field oil and gas development along the Rocky Mountain Front in Teton County, Montana. The EIS includes three alternative scenarios that focus on various levels (number of wells) of development and a No Action alternative. Because of the rights and expectations of oil and gas lease holders; the nature of oil and gas exploration and development; public concerns; the occupied threatened and endangered species habitat; the many resource values present in the region; recommendations from other agencies; and because BLM policy calls for a field development analysis after the second producing well has been developed, this draft EIS was prepared. The purpose is to provide a full discussion of any significant environmental impacts and cumulative effects that may result from full field development of this area.

0220 Transport, Handling, and Storage

43847 (EPRI-GS–6906) **Release detection for underground storage tank piping systems: Final report.** Rorty, M. (Weston (Roy F.), Inc., Walnut Creek, CA (USA)); Scheinfeld, R.A. Electric Power Research Inst., Palo Alto, CA (USA); Weston (Roy F.), Inc., Walnut Creek, CA (USA). ©Jul 1990. 51p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Piping is the portion of an UST system that is most vulnerable to leaks, thus an important part of any release detection program is the use of equipment to prevent or minimize releases from piping. US EPA regulations establish minimum release detection requirements for piping with which UST owners must comply. This report summarizes the technologies available for underground piping release detection and the federal regulatory requirements and industry consensus codes for UST system piping. Piping release detection systems include line tightness testing line leak detectors, and external release detection system and containment systems. Strategies for minimization of release potential are unique to each site and involve balancing the acceptable level of risk against the consequences of releases occurring from economic, social and institutional perspectives. Using the range of options presented in this report for piping release detection systems, UST owners can develop an UST management objective and select a commensurate level of protection offered by the range of devices and approaches available. An effective piping release detection system may incorporate several of the methods discussed in this report into one release detection system, with cost decisions based on formal estimates provided by manufacturers and contractors. Accurate estimates will reflect actual site conditions and limitations. An overview of release detection requirements for petroleum piping is briefly discussed. 31 refs., 1 figs., 4 tabs.

43848 (PB–90-223793/XAB) **Experimental measurements of displacements in oil-storage tanks caused by differential settlement.** Kamyab, H.; Palmer, S.C. Cambridge Univ. (UK). Dept. of Engineering. 1989. 144p. (CUED/D-STRUCT–129). Source: NTIS, PC EE10/MF E10.

Portions of this document are not fully legible.

Differential settlement of the foundation of large open-topped oil storage tanks can produce unacceptably large deflections of the tank shell. Large deflections may result in jamming of the floating roof. The report contains a collection of the results of displacement tests carried out on a small scale model. Each set of data is presented in graphical form and compared with the predictions of membrane analysis.

43849 (PB–90-224957/XAB) **Standard test procedures for evaluating leak-detection methods: Automatic tank gauging systems. Final report.** Flora, J.D.; Bauer, K.M. Midwest Research Inst., Falls Church, VA (USA). Mar 1990. 107p. Source: NTIS, PC A06/MF A01.

The handbook is one in a series of seven that describes EPA's standard test procedures for evaluating the performance of leak detection equipment for underground storage tanks. For each of the seven leak detection methods discussed in the series a procedure to test equipment in a consistent manner is provided. The edition provides an explanation of how to conduct the standardized test procedure, how to perform required calculations and how to report the results of the test for Automatic Tank Gauging Systems.

43850 (TAC–CE02875, pp. 165-172) **Groundwater control technique around underground crude oil storage caverns.** Shamoto, Y. (Kajima Inst. of Construction Technology, Tokyo (Japan)); Aoki, K. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

The ability to estimate rock mass permeability is of primary importance in the design of methods to maintain stable ground water tables above crude oil storage caverns. The results of ground water observation around an exploratory tunnel show that the depression of the ground water table is affected by the presence of geological discontinuities which connect to the tunnel. A practical procedure to determine the rock mass permeability from the number of cracks is proposed, its validity is examined, and a practical procedure to minimize groundwater depression during construction is proposed. 3 refs., 15 figs., 2 tabs.

43851 (TAC–CE02875, pp. 419-426) **Some design aspects of the large rock caverns for storing petroleum products.** Smiljkovic, Z.D. (Energoprojekt, Belgrade (Yugoslavia)); Damjanac, B.D.J. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper deals with the processes of interaction of materials as a basis for designing large rock caverns for the storage of petroleum products. These processes are classified according to a four-component model (rock mass-ground water-structure stored product) and are divided according to their origin into chemical, microbiological and mechanical processes. Some of these processes are characteristic of the construction phase, while the others are typical of the operating phase of underground storage plants. The flow regime of the ground water and its mechanical interaction with the rock mass around the cavern are discussed with the help of finite elements methods. For safe operation of underground storage sites for petroleum products and to decrease the risk of fuel impairment, the design process should consider the following interaction phenomena: chemical and microbiological interaction of fuel and ground water; and mechanical interaction between ground water, the individual rock mass blocks, the rock mass as a whole and the supporting structure. 11 refs., 7 figs.

0230 Properties and Composition

Refer also to citation(s) 44873, 44876

43852 (BNL–44824) **Effects of selected thermophilic microorganisms on crude oils at elevated temperatures and pressures: Quarterly report (April 1, 1990–April 31, 1990).** Premuzic, E.T.; Lin, M.S. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 4p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-76CH00016. Order Number DE90015677. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this program is to determine the chemical and physical effects of thermophilic organisms on crude oils and cores at elevated temperatures and pressures. Ultimately a data base will be generated which will be used in technical and economic feasibility studies leading to field application. Preliminary experiments with viscous oils have shown that conventional direct injection into GC-MS has to be modified, because of retention of residues on the chromatographic column. Currently we are investigating the utility of pyrolysis combined with gas chromatography and mass spectrometry technique. Complementary to this method, we are exploring the use of XANES spectra for the analysis of total changes in sulfur composition. 3 refs., 2 figs.

43853 (EGG-M–90019) **Measurement of interfacial tension by automated video techniques.** Deason, V.A.; Miller, R.L.; Watkins, A.D.; Ward, M.B.; Barrett, K.B. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-900756–23: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015464. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report describes a simple automated system for measuring interfacial tension using the pendant or sessile drop method. The size and shape of a transparent or opaque drop of one fluid immersed in a second, transparent, fluid is recorded with a CCD video camera and digitized and stored by a computer-controlled system. Custom software determines various droplet shape factors and computes the interfacial tension. A limited number of video frames can be stored on disc, or longer runs can be stored on video tape for later digitization. Alternatively, only the shape factor and interfacial tension data are stored to reduce demands on the storage medium. The first application of the system was measurement of the interfacial tension of crude oil interacting with various bacterial agents in aqueous suspension. Some of these agents can

greatly influence the effective interfacial tension of the crude oil and potentially improve recovery rates from oil reserves, particularly of the "heavier" or more viscous oils. 11 refs., 7 figs., 4 tabs.

43854 (ERL–88-62(TR)) **CANMET Energy Research Laboratories annual report, 1987/88.** Harcourt, J.L. (ed.). Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Energy Research Labs. May 1988. 112p. (MICROLOG–89-00495). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Energy Research Laboratories have been responding to the need for developing technologies related to fossil fuels and synthetic fuels. This report summarizes the Laboratories' activities for the current fiscal year. Objectives and achievements in a variety of subprograms of the three main divisions are outlined: combustion and carbonization, synthetic fuels, and fuel characterization. Subprogram areas include bitumen and heavy oil recovery and upgrading, conversion of natural gas to liquid fuels, coprocessing and coal conversion technologies, fluidized bed combustion, gasification, and biomass fuels for residential and industrial use. Support services are also described, and lists of staff, publications, presentations, contracts, and consultations are included. 1 fig.

43855 (NIPER–479) **Fuels research, Volume 1: Quarterly technical report, April 1–June 30, 1990.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). 27 Jul 1990. 33p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90015393. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fuels research from NIPER is described. The following two topics are briefly discussed: Department of Analytical Methodology for Analysis of Heavy Crudes, and Thermochemistry and Thermophysical Properties of Organic Nitrogen-, and Diheteroatom-Containing Compounds. 17 refs., 11 figs., 11 tabs.

43856 (PRI–90-03386) **Two- and three- phase relative permeability at elevated temperatures in heavy oil systems.** Petroleum Recovery Inst., Calgary, AB (Canada). Sep 1989. 126p. Contract EMR 23440-8-9019/01-SQ. (MICROLOG–90-03386). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Experiments were conducted with the objective of improving the understanding of 2- and 3-phase relative permability characteristics of heavy oil systems. Tests were conducted to evaluate the effect of flow rate on measurements by the displacement technique. The relative permeability in a viscous oil system is affected by the displacement velocity. This problem appears to be due to a combination of capillary effects and viscous instability The unsteady-state measurements of relative permeability were compared with steady-state measurements in the same rock-fluid system. Since viscous fingering is not a problem in the steady-state tests, it appears to provide more reliable results. To evaluate the effect of viscosity ratio, relative permeability measurements were carried out with mineral oils of different viscosities. It was shown that when the oil viscosity became high, as would be the case with heavy oils, relative permeability was affected by the oil viscosity. Three-phase relative permeability measurements were carried out at 100°C temperature and 3.5 megapascals pressure using the steady-state technique. The system used in these measurements comprised clean silica sand, a viscous mineral oil, water, and nitrogen gas. The 3-phase water relative permeability was a function of water saturation only. Similarly, the gas relative permeability was a function of gas saturation only. However, the oil relative permeability was found to vary with all three saturations. Stone's method I and II predictions of oil relative permeability correlated poorly with the experimental data. A better fit was obtained by a modified correlation suggested by Stone's method I. 42 refs., 66 figs., 9 tabs.

0250 Combustion

Refer also to citation(s) 43792, 44083, 44197, 44209, 44500, 44584, 44594

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 43897

43857 (PB–90-226333/XAB) **Geology of the Lower Cretaceous Travis Peak Formation, East Texas. Depositional history, diagenesis, structure, and reservoir-engineering implications. Topical report, November 1982-February 1990.** Dutton, S.P.; Laubach, S.E.; Tye, R.S.; Baumgardner, R.W.; Herrington, K.L. Texas Univ., Austin, TX (USA). Bureau of Economic Geology. Jun 1990. 184p. Source: NTIS, PC A09/MF A01.

See also PB–89-161418.

The report summarizes stratigraphic, petrographic, and structural studies of the Lower Cretaceous Travis Peak Formation, a low-permeability gas sandstone in East Texas, and presents reservoir engineering implications. Depositional systems in this region were interpreted from logs and cores and include (1) a braided- to meandering-fluvial system that forms the majority of the Travis Peak section; (2) deltaic deposits interbedded with the distal part of the fluvial system; (3) paralic deposits that overlie and interfinger with the deltaic and fluvial deposits near the top of the Travis Peak; and (4) shelf deposits present at the downdip extent of the formation. Petrographic studies indicate the sandstones are quartzarenites and subarkoses. Cementation by quartz, dolomite, ankerite, illite, chlorite, and reservoir bitumen have reduced porosity to less than 8 percent and permeability to less than 0.1 md throughout most of the formation. Structurally deeper sandstones are more intensely quartz cemented than are shallower sandstones and contain abundant, open natural fractures. Borehole breakouts and drilling-induced fractures in core can be used to predict horizontal stress directions and the direction of hydraulic fracture propagation. Hydraulic fractures propagate in directions subparallel to the east-northeast strike of the natural fractures; thus, hydraulically induced fractures may not intersect many natural fractures.

0303 Drilling, Production, and Processing

43858 (PB–90-228107/XAB) **Western Cretaceous Coal Seam Project. Final project summary. Final topical report, 1 January 1988-31 August 1989 (research).** Mavor, M.J.; Close, J.C. Resource Enterprises, Inc., Salt Lake City, UT (USA). 31 Dec 1989. 47p. Source: NTIS, PC A03/MF A01.

A summary of the Western Cretaceous Coal Seam project conclusions and data collection efforts is presented in the report. The discussion includes a summary of the geologic, formation evaluation, and stimulation analyses of four major wells. The names operators and locations of these wells are: Hamilton No. 3, Mesa Operating Limited Partnership, San Juan Co. NM, Sec. 30, Twn. 32 N, Rng. 10 W; Northeast Blanco Unit No. 403, Blackwood & Nichols Co., Ltd, Rio Arriba Co. NM, Sec. 9, Twn. 30 N, Rng. 7 W; Southern Ute - Mobil 36-1, McKenzie Methane Co., LaPlata Co. CO, Sec. 36, Twn 34 N, Rng. 10 W; and Colorado 32-7 No. 9, Mobil Oil Corp., LaPlata Co, CO, Sec. 4, Twn. 32 N, Rng. 7 W. The discussion includes a summary of 7 minor well efforts in addition to the above major efforts.

43859 (PB–90-228115/XAB) **Western Cretaceous Coal Seam Project: Evaluation of the cooperative research well southern Ute - Mobil 36-1. Operated by McKenzie Methane Corporation. Topical report, January 1988-December 1989.** Mavor, M.J.; Close, J.C. Resource Enterprises, Inc., Salt Lake City, UT (USA). 1 Dec 1989. 50p. Source: NTIS, PC A03/MF A01.

Cooperative well research efforts to investigate coalbed methane reservoir characteristics and post-stimulation deliverability is documented. The Southern Ute - 36-1 well was drilled in Section 36 of Township 34 North, Range 10 West of LaPlata County Colorado. The report documents the results of geologic, core, wireline log

and well test analyses. Coal content, gas content, permeability, thickness, and pressure estimates are presented. The analysis techniques are documented.

43860 (PB–90-228149/XAB) **Stress test and hydraulic-fracture analysis in the Frontier Formation. Texaco State of Wyoming U-NCT-1-No. 1, Bruff Field, Sweetwater County, Wyoming. Topical report, March 1990.** Miller, W.K.; Smith, M.B. NSI Technologies, Inc., Tulsa, OK (USA). 19 Mar 1990. 192p. Source: NTIS, PC A09/MF A01.

The results from in situ stress tests, performed in the Frontier Sands and three adjacent shale intervals, were used to derive a calibrated stress profile from the LSDS log. Coupling these stresses with those from two other GRI Frontier co-op wells, a preliminary correlation was developed between measured stress and log derived stress to characterize hydraulic fracture propagation. Additionally, a correlation was investigated between measured stress and lithology using the gamma-ray log. The results of a CO_2 minifrac are also discussed, determining foam leak-off properties and history matching treating pressures to calibrate the fracture design/analysis model for evaluating the main fracture treatment. The results of the history match indicate excessive height growth, as does the modeling of the main treatment, with created height much greater than propped height due to a pinch point effect in a shale above the pay. This leads to a probable explanation for the early screen-out on the main treatment based on excessive leak-off through the pinch point and a method for consideration to control this problem on future treatments.

43861 (PB–90-228172/XAB) **Western Cretaceous Coal Seam Project. Evaluation of the cooperative research well, Colorado 32-7 Number 9. Operated by Mobil Oil Corporation. Topical report, January 1988-December 1989.** Mayor, M.J.; Close, J.C. Resource Enterprises, Inc., Salt Lake City, UT (USA). 1 Dec 1989. 63p. Source: NTIS, PC A04/MF A01.

Cooperative well research efforts to investigate coalbed methane reservoir characteristics and post-stimulation deliverability is documented. The Colorado 32-7 No. 9 well was drilled in Section 4 of Township 32 North, Range 7 West of LaPlata County Colorado. The report documents the results of geologic, core, wireline log, well test, and stimulation diagnostic analyses. Coal content, gas content, permeability, thickness, pressure, and fracture geometry estimates are presented.

43862 (PB–90-239815/XAB) **Coal-seam Stimulation Manual. Topical report, January 1987-December 1988.** Holditch, S.A.; Ely, J.W.; Carter, R.H.; Semmelbeck, M.E. Holditch (S.A.) and Associates, Inc., Bryan, TX (USA). Apr 1990. 258p. Source: NTIS, PC A12/MF A02.

The report is a Coal Seam Stimulation Manual. It presents guidelines to design well completions and hydraulic fracturing treatments in coal seams. A major goal of the manual is to summarize the current knowledge concerning fracture treatment design, execution, and evaluation of treatments in coal seam reservoirs. It also includes information which will allow an engineer to determine if a coal seam reservoir is an economically viable candidate for fracture stimulation.

43863 (PB–90-240342/XAB) **Staged Field Experiment No. 2: Application of advanced geological, petrophysical and engineering technologies to evaluate and improve gas recovery from low-permeability sandstone reservoirs. Travis Peak Formation, North Appleby Field, Nacogdoches County, texas. Volume 2. Topical report.** CER Corp., Las Vegas, NV (USA). Apr 1990. 255p. Source: NTIS, PC A12/MF A02.

See also PB–90-198474.

The Gas Research Institute has sponsored research directed towards improving the recovery efficiency and reducing the cost of producing gas from tight reservoirs. To more effectively acquire data and perform research experiments, the concept of Staged Field Experiments (SFE) was developed. SFE No. 2 had specific objectives which included implementing data collection methods which would be structured to benefit the research contractors advancing various formation evaluation and hydraulic fracture technologies. Volume II of the two part SFE No. 2 series includes detailed discussions and results of pre-fracture well testing, fracture diagnostics, fracture modeling and post-fracture reservoir modeling in upper and lower Travis Peak completion intervals.

43864 (PB–90-240367/XAB) **Tight Gas Sands Research Program: Field operations and analysis. Post-fracture production and pressure-transient analysis of SFE No. 1. Annual report, January 1987-December 1987.** Holditch, S.A.; Robinson, B.M.; Whitehead, W.S. Holditch (S.A.) and Associates, Inc., Bryan, TX (USA). 11 Jan 1988. 67p. Source: NTIS, PC A04/MF A01.

Color illustrations reproduced in black or white.

The Gas Research Institute sponsored its first Staged Field Experiment (SFE) in 1986. The SFE was a gas well drilled and completed in the Travis Peak formation in Harrison County, Texas, for the specific purpose of conducting research on the process of hydraulic fracturing. Numerous research organizations were involved in formation evaluation, fracture diagnostics and post-fracture evaluation of the SFE well. The authors have concluded that the main fracture treatment created a fracture that propagated up and communicated the Travis Peak C-1 sand, which was the main completion zone, to the B-1 sand. The propped fracture length is 150 ft with a conductivity of 2550 md-ft. The fracture treatment resulted in a 3.6 fold increase in productivity. In general, the post-fracture analysis of SFE No. 1 agrees well with the estimated fracture geometry and dimensions that have been reported by GRI fracture diagnostics contractors.

43865 Production in gas hydrate zones and its potential problems. Malone, R.D. (Dept. of Energy, Morgantown, WV (USA)); Lawson, W.F.; Siriwardne, H.J. *AAPG Bulletin (American Association of Petroleum Geologists) (USA)*, 74(5): 712 (May 1990). (CONF-900605–: Annual convention and exposition of the American Association of Petroleum Geologists, San Francisco, CA (USA), 3-6 Jun 1990).

Gas hydrate is an attractive energy resource in view of the large amount of gas that potentially can be produced. Research over the past 5 yr has resulted in an understanding of the formation of gas hydrates through laboratory research and an understanding of the geological environment within which gas hydrate deposits occur. Vast amounts of natural deposits of hydrates have been identified and a number of conceptual models have been developed for recovery of this resource. In the development of extraction technology for gas hydrates, it is necessary to have an understanding of the geomechanical behavior of reservoir materials. Numerous technical production problems are anticipated in producing gas from hydrate fields. These problems include the lack of knowledge for determining the vertical and horizontal continuity of the hydrate deposits, determining the amount of heat loss to the overburden and underburden sediments, predicting the actual dissociation front of the hydrate, and evaluating the potential for problems associated with subsidence within the permafrost. This report provides conceptual designs for hydrate production and information relative to the potential subsidence associated with hydrate production. The studies were performed to establish possible variation expected for different reservoir conditions. The results from this investigation can be useful in estimating the magnitude of ground movement problems associated with hydrate production.

0304 Products and By-Products

43866 (PB–90-227422/XAB) **Some implications of the application of propane in domestic refrigerators. Research memo.** Wong, A.K.H. Polytechnic of the South Bank, London (UK). Inst. of Environmental Engineering. Feb 1990. 12p. (RM–123). Source: NTIS, PC EE06/MF E06.

The implications of applying propane in domestic refrigerators in terms of energy consumption, compressor lubrication, costs, availability, ozone interaction and standards are discussed in the paper.

0305 Health and Safety

43867 (PB–90-228131/XAB) **Reduction of LNG operator error and equipment failure rates. Topical report, 20 April 1990.** Atallah, S.; Shah, J.N.; Betti, M. Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA). Apr 1990. 48p. Source: NTIS, PC A03/MF A01.

Tables summarizing human error rates and equipment failure frequencies applicable to the LNG industry are presented. Improved training, better supervision, emergency response drills and improved panel design were methods recommended for reducing human error rates. Outright scheduled replacement of critical components, regular inspection and maintenance, and the use of redundant components were reviewed as means for reducing equipment failure rates. The effect of reducing human error and equipment failure rates on the frequency of overfilling an LNG tank were examined. In addition, guidelines for estimating the cost and benefits of these mitigation measures were considered.

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 43776, 43811, 43815, 43817, 43822, 43823, 43825, 43837, 43883, 43885, 43886, 43894, 44211, 44462, 44465, 44601

43868 (CERI–90-01031, pp. 1-28, Section 5) **Perspectives on a hot market for gas.** Makowski, J. (J. Makowski Co., Inc., Boston, MA (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper quantifies the electric generation market for natural gas in the northeast U.S., particularly in non-utility generation; explains the characteristics of the electric generation market, shows why natural gas is competitive with other fossil fuels, and indicates where the supply might come from. The demand in the New England power market is increasing, and cannot be met by coal-fired or nuclear generating stations because of permitting and construction time constraints. This leaves natural gas turbines to provide needed power. Since the pattern of natural gas use for generation of electricity is the opposite to that for heating, pipelines can have a high load factor, which should also lead to acceptable netback prices at the well head. 1 tab., 11 figs.

43869 (CERI–90-01031, pp. 1-9, Section 3) **Outlook for LNG [liquefied natural gas] markets worldwide.** Peebles, M.W.H. (Shell International Gas Ltd., London (England)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper covers expected supply and demand for liquefied natural gas (LNG) in the Pacific Basin, particularly Japan and South Korea, in Europe and in the U.S. While demand will continue to increase in the Pacific Basin and Europe, in the U.S. LNG imports could be a useful supplement to indigenous gas and Canadian pipeline gas imports provided they can be delivered at the right locations at marketable prices. The main limitation is likely to be the difficulty of increasing terminal capacity because of the problems with receiving approval to construct more facilities. 10 figs.

43870 (CERI–90-01036, pp. 1-20, Paper 15) **Gas market developments in Western Europe.** Odell, P.R. (Centre for International Energy Studies, Erasmus Univ., Rotterdam (Netherlands)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper describes the main features of western European natural gas developments, their beginnings and development to the mid-1980s, and the current situation. The market is characterized by a great deal of inertia in the transmission/distribution areas and a climate of opinion which considers natural gas to be inherently scarce, and therefore to be conserved for the long-term. The Sleipner/Troll deal is evaluated as a breakthrough into this static market, as are the recent political and economic developments in the Soviet Union. The implications of greatly expanded Soviet gas imports are discussed. It is concluded that the potential availability of much increased volumes of lower cost gas seems to be the only serious possibility for overthrowing the propensity of the gas suppliers, distributors and governments in Western Europe to take high economic rents by making cheap gas available to customers at high prices. This would make western Europe a more important gas using region by the early years of the 21st century, reducing the use of coal and oil, slowing electrification, and providing the chance for Europe to move towards a non-nuclear system. 2 tabs., 5 figs., 5 refs.

43871 (MPUB–61/90) **Inquiry into the indirect acquisition of the shares of ICG Utilities (Manitoba) Ltd. by Westcoast Energy Inc.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 26 Jan 1990. 18p. (CE–02999). Source: Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2. Prices: PRICES UPON REQUEST.

In December 1988, Central Capital Corporation, holding a 46% interest in Inter-City Gas Corporation, announced publicly that it wished to dispose of its investment in Inter-City. While the intended sale attracted other prospective buyers, the Westcoast Energy Inc. offer was accepted. Westcoast agreed to purchase Inter-City's propane and utility division, conditional upon approvals of requisite regulatory bodies in British Columbia, Alberta, Manitoba and Ontario. This hearing is part of this regulatory process and consists of an inquiry into the acquisition, indirectly, of the shares of ICG Utilities (Manitoba) Ltd. by Westcoast. The hearing dealt with the financial positions of Westcoast and ICG Manitoba; the management capability and operations of Westcoast; conflicts of interest; the ongoing regulatory process; and the intervenors' positions. The Board concluded that the management of Westcoast had sufficient capability and experience to operate ICG Manitoba in the public interest, with no evidence of conflict of interest. The acquisition of the shares was therefore approved. 1 tab., 1 fig.

43872 (OME–90-01732, pp. 1-34, Paper 14) **Gas sales contract.** Adie, B. (Union Gas Ltd., Chatham, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A review of purchase-transportation and gas sales contracts in Canada is presented. Important aspects of each are highlighted, ie. interpretation, conditions precedent, term, gas volume, price, possession and title, invoicing and payment procedures, default section, force majeure, cogeneration consideration, rates, delivery pressure. 2 figs., 20 tabs.

43873 (OME–90-01732, pp. 1-9, Paper 13) **Gas pricing for cogeneration projects.** Otsason, J. (Consumers' Gas Co., Scarborough, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The significant decline in gas prices, along with escalating electricity prices, dramatically improves the economic viability of gas fired cogeneration. The delivered gas price is made up of three major components: the price of the commodity; transportation from the province of supply to Ontario through the Trans Canada Pipeline (TCPL) system; and transportation by the utility from the TCPL to the plant. The commodity component is the only component of the delivered price that is deregulated and will be governed by the supply/demand relationship and the seller's expectations about future changes in this relationship. Sellers are prepared to offer three basic types of gas supply contracts. The first type would be for a short term of usually one or two years, or up to five years but at a premium of up to 10-15% over the short term price. The second type would be for terms of up to five years, with the first year price equal to or slightly higher than the one year price and annual escalation rates usually in the 0.5-0.10 cent/GJ range. The third type is a long-term, indexed contract which has a first year price that is 10-20% higher than the price for a one year contract with the magnitude of the premium depending on the type of index and the term of the contract. The following are some of the commonly suggested indexing factors: the Consumer Price Index, Ontario Hydro buy back rate, Ontario Hydro bulk power or industrial electricity rates, oil prices and gas prices. 1 fig., 1 tab.

43874 (PB–90-244286/XAB) **Unaccounted-for gas project. Final report.** Cima, K.M.; Cottengim, T.L.; Wong, R.M.; Cowgill, R.M.; Grinstead, J.R. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 1446p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-244294 through PB–90-244351.

The project was undertaken to quantify the losses of gas volume from a gas transmission and distribution system in California due to leaks, customer theft, accounting methods, and gas meter inaccuracies. Separate reports on the findings from each of the four task groups are included on the database.

43875 (PB–90-244294/XAB) **Unaccounted-for gas project: Summary volume. Energy delivery and control. Final report.** Cima, K.M.; Cottengim, T.L.; Wong, R.M.; Cowgill, R.M.; Grinstead, J.R. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 198p. Source: NTIS, PC A09/MF A02.

See also Volume 1, PB–90-244302; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was aimed at determining unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric Co.'s transmission and distribution systems during 1987. The Theft Task Force analyzed the percentage of customers involved in gas theft, the average annual volume of gas stolen by a single customer, and the total number of customers and their total gas usage. Results were used in conjunction with documented customer theft to arrive at a calculation that more accurately reflected the theft contribution to UAF for 1987.

43876 (PB–90-244302/XAB) **Unaccounted-for gas project. Accounting Task Force. Volume 1. Energy delivery and control. Final report.** Luttrell, D.J.; Nelson, F.A.; Peterson, J.D.; Cowgill, R.M.; Waller, R.L. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 199p. Source: NTIS, PC A09/MF A02.

See also Summary Volume, PB–90-244294; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was conducted to determine unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric (PG&E) Co.'s transmission and distribution systems during 1987. The Accounting Task Force analyzed purchases and transport received, sales and transport delivered, interdepartmental sales, and gas department use to determine the effect on UAF. Findings show that accounting adjustments and cycle billing have a major impact on the 1987 operating UAF.

43877 (PB–90-244310/XAB) **Unaccounted-for gas project. Measurement Task Force (non-orifice meter studies). Volume 2A. Final report.** Luttrell, D.J.; Noistering, R.H.; Peterson, J.D.; Cowgill, R.M.; Waller, R.L. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 323p. Source: NTIS, PC A14/MF A02.

See also Volume 1, PB–90-244302 and Volume 3, PB–90-244328; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was conducted to determine unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric Co.'s transmission and distribution systems during 1987. The Measurement Task Force identified the amount of UAF attributable to measurement inaccuracies. Results show that the major residential measurement-related UAF elements, fixed-factor temperature and elevation/barometric pressure effects, contribute to UAF due to assumptions inherent in the billing calculation for average temperature and elevation which are then applied to all residential customers.

43878 (PB–90-244328/XAB) **Unaccounted-for gas project. Measurement Task Force (orifice meter studies). Volume 2B. Final report.** Godkin, B.J.; Robertson, J.D.; Wlasenko, R.G.; Cowgill, R.M.; Grinstead, J.R. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 283p. Source: NTIS, PC A13/MF A02.

See also Volume 2A, PB–90-244310 and Volume 3, PB–90-244336; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was aimed at determining unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric Co.'s transmission and distribution systems during 1987. Activities and methods are described and results are presented for research conducted on orifice meter accuracy. The Measurement Task Force determined that orifice metering inaccuracies were the largest single contributor to 1987 UAF.

43879 (PB–90-244336/XAB) **Unaccounted-for gas project. Theft Task Force. Volume 3. Final report.** Cima, K.M.; Cottengim, T.L.; Wong, R.M.; Cowgill, R.M.; Grinstead, J.R. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 41p. Source: NTIS, PC A03/MF A01.

See also Volume 2B, PB–90-244328 and Volume 4, PB–90-244344; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was aimed at determining unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric Co.'s transmission and distribution systems during 1987. The Theft Task Force analyzed the percentage of customers involved in gas theft, the average annual volume of gas stolen by a single customer, and the total number of customers and their total gas usage. Results were used in conjunction with documented customer theft to arrive at a calculation that more accurately reflected the theft contribution to UAF for 1987.

43880 (PB–90-244344/XAB) **Unaccounted-for gas project. Leak Task Force. Volume 4. Final report.** Cowgill, R.M.; Robertson, J.L.; Grinstead, J.R.; Luttrell, D.J.; Walden, E.R. Pacific Gas and Electric Co., San Ramon, CA (USA). 7 Jun 1990. 116p. Source: NTIS, PC A06/MF A01.

See also Volume 3, PB–90-244336 and Volume 5, PB–90-244351; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study was aimed at determining unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric Co.'s transmission and distribution systems during 1987. The Leak Task Force quantified unintentional gas losses (leakage and dig-ins). Results show that 1987 gas leakage accounted for less than 5% of the operating UAF.

43881 (PB–90-244351/XAB) **Unaccounted-for gas project. Data bases. Volume 5. Final report.** Cowgill, R.; Waller, R.L.; Grinstead, J.R. Pacific Gas and Electric Co., San Ramon, CA (USA). Jun 1990. 286p. Source: NTIS, PC A13/MF A02.

See also Volume 4, PB–90-244344; Also available in set of 7 reports PC E99/MF E99, PB–90-244286.

The study identifies, explains, and quantifies unaccounted-for (UAF) gas volumes resulting from operating Pacific Gas and Electric (PG&E) Co.'s gas transmission and distribution systems during 1987. The results demonstrate that the UAF volumes are reasonable for determining the indirectly billed gas requirements component of the gas cost and for operating the PG&E gas system. Gas leakage is a small percentage of UAF. Summaries of studies on gas leakage, gas theft, measurement inaccuracies, and accounting methodologies are presented along with recommendations for further work which could reduce or more accurately measure UAF.

0307 Waste Management

Refer also to citation(s) 44209

0308 Environmental Aspects

Refer also to citation(s) 43841, 43846

43882 (PB–90-228065/XAB) **High-expansion foam for LNG vapor mitigation. Topical report, September 1987-December 1989.** Atallah, S.; Shah, J.N.; Peterlinz, M.E. Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA). 1 May 1990. 71p. Source: NTIS, PC A04/MF A01.

One of the purposes of these high expansion foam systems is to reduce the extent of the hazardous vapor cloud generated during an accidental LNG release. Should the LNG ignite, these systems serve the additional function of controlling the LNG fire and minimizing its radiation to the surroundings. Foam generators have been installed along the tops of dike walls surrounding some LNG storage tanks, and around other fenced containment areas where LNG may be accidentally released, such as LNG pump pits and pipe rack trenches. To date there are no technically justifiable guidelines for the design and installation of these systems. Furthermore, there are no models that may be used describe the vapor source so as to be able to predict the reduction in the hazardous vapor cloud zone when high expansion foam is applied to an LNG spill. Information is essential not only for the optimal design of high expansion foam systems, but also for comparing the cost effectiveness of alternative LNG vapor mitigation measures.

0310 Legislation and Regulations

Refer also to citation(s) 43871, 43890, 44463, 44465

43883 (CERI–90-01031, pp. 1-37, Section 5) **Ontario gas market developments.** Hunter, J.C. (Union Gas Ltd., Chatham, ON (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper presents an overview of the pre-deregulation situation, reviews the activities and events since deregulation, comments on the next decade in gas marketing, and makes specific recommendations for both buyers and sellers. The paper indicates the effect of the deregulation on Union Gas' contract negotiations. Both the Ontario and the U.S. markets are described, along with their characteristics in a number of common areas. Recommendations for buyers include planning for tightening supply and price, the need for long-term protection, and the avoidance of unduly punitative contractual terms. Recommendations for sellers include the need to learn about the marketplace personally, recognition of the vulnerabilities of export projects, the need to push for advance capability, and care for the empty pipe risk. 5 tabs., 9 figs.

43884 (CERI–90-01036, pp. 1-13, Paper 13) **The effects of the November 1986 deregulation of the Canadian gas industry: The marketer's perspective.** Minion, D.W. (Morthridge Petroleum Marketing, Inc., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper evaluates the deregulation of the Canadian gas industry from a marketer's perspective and relates it to principles outlined by the federal government. These principles include market responsive pricing set by negotiations between buyers and sellers; open transportation access; respect by governments for existing contracts; greater access to markets for domestic and export producers; greater access to gas supplies for consumers; less government regulation and control within the marketplace; an orderly transition from the regulated world to the deregulated environment that is fair to both producers and consumers; and a regime that will have favourable impacts on investment, employment and trade in order to provide energy security for Canadians. The paper concludes by rating the deregulation as seen so far as measured progress towards a system in which marketers have non-discriminatory access to supply, to consumers and transportation, as well as equitable access to regulatory and political approvals. An appendix includes the text of the 1985 Agreement on Natural Gas Markets and Prices and the news release referred to.

43885 (CERI–90-01036, pp. 1-17, Paper 11) **Consumers gas.** Martin, R.W. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper presents distributor's point of view on the 1986 agreement which deregulated natural gas in Canada. The paper discusses the expected effects of lower prices on both large and small customers, concluding that residential and smaller commercial and industrial customers have not seen the same benefits as large customers. A number of issues stand in the way of an open market, among them long-term contracts and their enforcability and sanctity, the definition of core and non-core markets, removal permits, security of supply, the rights and obligations of distributors, and the role of brokers. However, the main areas of concern are fairness and long term security. Equally important is the need for adequate competitively priced supplies of gas to the domestic market before it is sold in the U.S. export market.

43886 (CERI–90-01036, pp. 1-10, Paper 2) **The effect of the November 1986 deregulation of the Canadian gas industry: The consumer's perspective.** Bjerkelund, T. (Industrial Gas Users Association, Ottawa, ON (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper explains the aims and objectives of the Industrial Gas Users' Association and their involvement in the events leading up to the November 1986 deregulation of natural gas prices; reviews the positions of the association on the current issues before the various regulatory boards, particularly the National Energy Board's recent natural gas surplus determination procedures hearing; and discusses such concerns as the Alberta floor price and other constraints to a market-responsive environment. The paper concludes by expressing the association's concern that the market-responsive environment contemplated in the 1985 Agreement on Natural Gas Markets and Prices will survive, since the producers and the producing provinces do not see themselves as having received all that they were looking for, particularly in improved export sales and revenues. A membership list of the association is included.

43887 (MPUB–1/90) **Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd.: Application for a final order confirming changes in sales rates effective November 1, 1989 and January 1, 1990 pursuant to interim ex parte order no.174/89 and other related matters.** Manitoba Public Utilities Board, Winnipeg, MB (Canada). 2 Jan 1990. 20p. (CE–03030). Source: Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2. Prices: PRICES UPON REQUEST.

In October 1989, the two companies applied to the board for an interim order approving interim rates for November and December

1989 and annual rates from January to October 1990, and the establishment of deferral accounts, as well as a final order approving the interim rates and the deferral account. The board approved the rate schedules on an interim basis, but deferred the final order until all interested parties had had a chance to review the application and examine the Companies' witnesses. This public hearing deals only with the confirmation or otherwise of the interim order and the establishment of deferral accounts. The document lists the witnesses, the intervenors and the presenters, and considers peaking requirements and aspects of the deferral accounts. The interim schedule of rates was confirmed; the annual schedule of rates was rescinded; the implementation of deferral accounts relating to the monthly variance in the TransCanada Pipeline fuel ratio and the ProGas Ltd. peaking supply was approved; and the implementation of a deferral account related to the Valley Transpóration Credit was denied. 5 tabs.

43888 (NPA–BT31-2/1991-III-31) **Northern Pipeline Agency Canada, 1990-91 estimates: Part 3. Expenditure plan.** Northern Pipeline Agency, Ottawa, ON (Canada). 1990. 38p. (MICROLOG–90-03664). Source: PC Northern Pipeline Agency, Lester B. Pearson Building, 125 Sussex Drive, Ottawa, ON, CAN K1A 0G2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $3.00; OTHER COUNTRIES: $3.60 CAN; MF $10 CAN.

The Northern Pipeline Agency was established to facilitate the efficient and expeditious planning and construction of the Alaska Highway Gas Pipeline in a manner consistent with the best interests of Canada as defined in the Northern Pipeline Act. This document presents an overview of the Agency's programs, highlights of plans and recent performance, and a profile of program resources. Detailed budgets for various parts of the program are included. 3 figs., 5 tabs.

0320 Transport, Handling, and Storage

Refer also to citation(s) 43874, 43875, 43876, 43877, 43878, 43879, 43880, 43881

43889 (CERI–90-01031, pp. 1-11, Section 5) **An Iroquois update.** Reid, R.J. (Iroquois Gas Transmission System, Shelton, CT (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Iroquois natural gas pipeline is long, running 370 miles from Western Canada to New England. This paper provides an update on where the pipeline is in the regulatory process in both Canada and the U.S. and the status of the shippers. The project is on target and now ready to move into the detailed environmental and engineering aspects.

43890 (CERI–90-01031, pp. 1-9, Section 5) **Regional pipeline constraints and developments.** Duda, F. (California Public Utilities Commission, San Francisco, CA (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper describes the regulatory stages in the so far unsuccessful attempt to build a pipeline from Arizona to the heavy oilfields in Kern Country, California. Variations on this proposal are also described, as is the Altamont proposal to supply California with Canadian natural gas.

43891 (CGA/ES–CE03115) **Directory of gas distribution transmission and production companies, 1989.** Canadian Gas Association, Don Mills, ON (Canada). Economics/Statistics Dept. Dec 1988. 100p. (CE–03115). Source: Canadian Gas Association, 55 Scarsdale Rd, Don Mills, ON, CAN M3B 2R3. Prices: N/C.

This directory provides information, by province, on Canadian Gas Association gas production members, divided into gas distribution, transmission, and production companies. Information was provided by the listed companies and is applicable to December 1989. Each listing includes details on corporate organization, area and population served, employees, sales, exploration, demand, and storage facilities. Included are provincial maps of the pipeline distribution system.

43892 (FRNC-TH–3599) **Theoretical and experimental study of capillary pressure hysteresis and relative permeability for natural gas underground storage.** Aissaoui, A. Paris-6 Univ., 75 (France); Ecole Nationale Superieure des Mines, 75 - Paris (France). 1983. 207p. (In French). Order Number DE90514555. Source: NTIS (US Sales Only), PC A10/MF A01.

After a bibliographical review on two-phase flow in porous media, influence of gas and water flow in the reservoir rock on storage possibilities is examined. The material chosen for the study is Fontainebleau sandstone. Porosity, permeability, gas and water saturation are measured. Relationship between residual and maximal gas saturation is determined Capillary pressure hysteresis and relative permeability to gas are modelised. The Killough model is tested and adapted to sandstone.

43893 (PB–90-228073/XAB) **LNG vapor mitigation by doubling tank-wall integrity. Topical report, September 1987-March 1989.** Atallah, S.; Shah, J.N. Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA). 16 Apr 1990. 31p. Source: NTIS, PC A03/MF A01.

A review of the results of numerous experimental studies on the crack arrest capabilities of 9% nickel-steels and the heat-affected zone has confirmed the excellent historical experience with these materials when used for LNG and other cryogenic liquid storage. In the absence of any actual unzippering tank wall failures involving 9% nickel-steels, the historical data can only suggest that the failure rate of such tanks is much less than 5 x 10(-4) per year. The capability of a second external 9% nickel-steel wall to withstand the asymmetric load and thermal shock resulting from a catastrophic failure of the inner wall was questioned. A concrete wall built around an existing LNG tank, buttressed by an earthen berm is one of several alternative means for reducing the extent of a vapor cloud should the existing tank fail. Guidelines for estimating the initial and annual costs of such a structure are given.

43894 **Pricing and optimal capacity with economies of scale: implications for gas.** Hanson, D.A. (Argonne National Lab., IL (USA)); Bassett, G.W. Jr. pp. 375-386 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). DOE Contract W-31-109-ENG-38. (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper develops a general theory of optimal capacity with economics of scale and describes the relationships among pricing, sales, and optimal capacity. It discusses the application to natural gas pipelines and, in particular, the problem of expanding capacity to serve the New England market. It is suggested that the Ramsey version of peak-load pricing may lower the peak price, provided that capacity is expanded to its optimal level in the presence of decreasing long-run marginal costs (LRMCs) and that additional gas markets could be economically developed with pricing policies that take advantage of the low cost of incremental capacity. The traditional literature on LRMC and peak load pricing are related to a general cost function specification consistent with microtheory. Several implications of scale economies in capacity are examined.

0330 Properties and Composition

Refer also to citation(s) 44873

43895 (PB–90-228156/XAB) **Properties of CO_2 mixtures with N_2 and with CH_4. Topical report, June 1988.** Bailey, D.M.; Esper, G.J.; Holste, J.C.; Hall, K.R.; Eubank, P.T. Texas A and M Univ., College Station, TX (USA). Research Foundation. Jun 1988. 79p. Source: NTIS, PC A05/MF A01.

Also pub. as Gas Processors Associations, Tulsa, OK. rept. No. GPA-122.

The project objective is to produce accurate, self consistent thermodynamic property data for mixtures of carbon dioxide with other natural and synthetic gas components. The thermodynamic properties include density, virial coefficients, energies (internal, Helmholtz, Gibbs), enthalpy, entropy, and phase equilibrium. The natural and synthetic gas components are methane, ethane, nitrogen, and hydrogen sulfide. The report includes Burnett and Burnett-isochoric data for two gravimetrically prepared, nominally equimolar mixtures of carbon dioxide with methane and with nitrogen. For each mixture the Burnett measurements are at 300 and 400 K (80 and 260F), and the Burnett-isochoric measurements are in the range 205 < T/K < 320 (-90 < t/F < 116) and 0.1 < P/MPa < 48(15 < P/psia < 7,000). Derived properties reported here include densities, second and third virial coefficients, interaction second virial coefficients, energies, enthalpies, and entropies. Portions of the VLE boundaries within the range of the measurements also are reported.

43896 (PB–90-228164/XAB) **Development of ab-initio molecular potentials for certain alkanes. Annual report, 1 January 1989-31 December 89.** Beck, D.R.; Woon, D.E.; Gay, D.H. Michigan Technological Univ., Houghton, MI (USA). Dept. of Physics. 16 Jan 1990. 81p. Source: NTIS, PC A05/MF A01.

See also PB–90-127507.

The authors have completed ab initio potential energy surfaces for H2S-H2O, and refined (more points, better fits) the earlier surfaces. With these potentials, a mixture of CH4, H2O, and H2S can be simulated. Work on the ethane surface is continuing. Their potentials have been used to evaluate second virial coefficients. Generally, accuracies are 30%, though for H2S, their most developed surface, they are 15% (the results also indicate the unreliability of some of the older measurements). The authors have also obtained radial distribution functions, and internal energies using a constant NVT molecular Monte Carlo program they wrote. Results for pure H2O and pure H2S are as good or better than other ab initio values. The results suggest that the potentials need the most improvement, and that this should be done by improving the description of the dipole polarizabilities. The authors are completing the programming of fourth order perturbation theory to do this; the use of field dependent orbitals is also being examined (this may allow a lower order of perturbation theory to be used). The overall objective is to develop accurate molecular potential energy surfaces for use in computer simulation studies of natural and synthetic fuel mixtures.

0340 Combustion

Refer also to citation(s) 43866, 44083, 44209, 44603, 44957

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

43897 (PB–90-230129/XAB) **Geology of the lower Yellow Creek Area, Northwestern Colorado.** Hail, W.J. Geological Survey, Alexandria, VA (USA). 1990. 53p. (USGS-BULL–1787-O). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

The lower Yellow Creek area is located in Rio Blanco and Moffat Counties of northwestern Colorado, about midway between the towns of Rangely and Meeker. The study area is in the northwestern part of the Piceance Creek basin, a very deep structural and sedimentary basin that formed during the Laramide orogeny. Potentially important resources in the area are oil shale and related minerals, oil and gas, coal, and uranium. Topics discussed in the report include: Stratigraphy (Subsurface rocks, Cretaceous rocks, Tertiary rocks, and Quaternary deposits); Structure (Midland anticline, graben at Pinyon Ridge, and Crooked Wash syncline, Folds and faults in the vicinity of the White River, Red Wash syncline and central graben zone, Yellow Creek anticlinal nose); Economic geology (Oil shale and associated minerals, Coal, Oil and gas, Uranium, Gravel).

43898 (PB–90-230152/XAB) **Log-derived regional source-rock characteristics of the Woodford Shale, Anadarko Basin, Oklahoma.** Hester, T.C.; Schmoker, J.W.; Sahl, H.L. Geological Survey, Alexandria, VA (USA). 1990. 45p. (USGS-BULL–1866-D). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card No. 89-600220.

The Woodford Shale is an organic-rich, highly compacted, black shale of Late Devonian and Early Mississippian age that is widely regarded as a major hydrocarbon source rock in the Anadarko basin of Oklahoma. The report describes regional depositional trends and organic-carbon content of the Woodford Shale as evidenced by wire-line logs in the Oklahoma portion of the Anadarko basin. The relation between depositional patterns and organic-carbon content is discussed, and the mass and distribution of organic carbon in thermally immature and mature areas of the Woodford Shale is estimated.

0404 Oil Production, Recovery, and Refining

43899 (GCR–90-03384) **Impact of steam additives on the productivity of the cyclic steam stimulation process.** McCorriston, L.L.; Trocan, V.; Boyd, J.G. Gulf Canada Resources Ltd., Calgary, AB (Canada). Nov 1988. 205p. Contract EMR 23440-7-9064/01-SQ. (MICROLOG–90-03384). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A series of field tests were undertaken at the Pelican Lake, Alberta (Wabasca Deposit) heavy oil project to investigate the effects of steam additives, as well as standard boiler effluents, on oil production by cyclic steaming. The various process mechanisms which affect heavy oil recovery were also examined. The additive selected on the basis of criteria including compatibility with Pelican Lake reservoir water was Suntech IV FA, a mixture of alkyltoluene sulfonates and an alkaline silicate. Eight primary production wells drilled in 1986 were selected for the tests, and were divided into pairs. Each pair selection was made to match wells based on comprehensive geological, reservoir, and production data so that production responses between additive and non-additive wells could be compared. In all cases, the steaming parameters remained consistent with regard to injection rate, volume, and feedwater composition. Additive injection procedures were also consistent between all additive wells. The study did not indicate any definite evidence to indicate that cyclic steam stimulation is enhanced through the use of Suntech IV FA. No consistency was observed in oil production trends between the additive and non-additive wells. However, the effect on water production appears quite pronounced, exceeding area averages in all cases by 16-60% in the additive wells. A small but insufficient amount of evidence indicated that Suntech IV FA may be slightly more effective as a steam additive in higher watercut environments. 66 refs., 108 figs., 21 tabs.

43900 (TAC–CE02875, pp. 157-164) **The AOSTRA [Alberta Oil Sands Technology and Research Authority] underground test facility for in situ recovery of bitumen from oil sands.** Scott, J.D. (Univ. of Alberta, Edmonton, AB (Canada)); Chalaturnyk, R.J.; Haston, J.A.; Wood, D.F.; Stokes, A.; Laing, J.M. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling:*

Volumes 1 and 2. Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

The Alberta Oil Sands Technology and Research Authority Underground Test Facility (UTF) located near Fort McMuray, Alberta, is currently being used to test the shaft and tunnel access concept for the in situ recovery of bitumen from oil sands. The Phase A testing program, which commenced in December, 1987, is designed to evaluate in situ steam assisted gravity drainage recovery of bitumen from the oil sands using near horizontal wells drilled from the tunnels. The geologic setting at the UTF site is described and its impact on the design and construction of the shafts and tunnels discussed. Mining procedures used for the shafts and tunnels are given, and the shaft and tunnel perfomance to date discussed. The strict environmental monitoring and safety procedures utilized in the mine follow those of a gassy coal mine. For the Phase A program, 3 pairs of wells were drilled from the tunnels into the oil sands from underground drilling chambers. The wells rise through the limestone, intersect the limestone-oil sands interface about 50 to 95 m from the well head and then extend 65 to 100 m horizontally through the lower level of the oil sands deposit. Each wellhead is anchored into the limestone rock of the tunnel walls. As steam is circulated through the well, the limestone is heated from a virgin rock temperature of 11°C up to 225°C. Extemsive geotechnical instrumentation has been installed to monitor rock response to steaming operations. A description of the program is given, and examples of instrumentation readings from the tunnel monitoring program are shown. 10 refs., 12 fig.

0406 Products and By-Products

43901 (CSCHE–CE03090-Vol.2, pp. 525-531) **Recovery of vanadium from Suncor flyash - flowsheet development.** Lakshmanan, V.I. (ORTECH International, Mississauga, ON (Canada)); McQueen, N. Canadian Society for Chemical Engineering, Ottawa, ON (Canada). 1989. (CONF-891070–: 2. international conference on separation science and technology, Hamilton (Canada), 1-4 Oct 1989; CE–03090). In *Proceedings of 2nd international conference on separations science and technology: Vol. 2.* Source: Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, ON, CAN K1G 3Y6. Prices: PRICES UPON REQUEST.

Tarsands, like crude oils, contain trace metals associated with hydrocarbon constituents. Processing of tarsands to recover petroleum products at Suncor operations in Fort McMurray, Alberta, produces a carbonaceous product during the coking process. Burning the coke in the boiler plant produces flyash material containing vanadium, nickel and several other minor metallic metals. A systemic bench and pilot scale test was carried out to separate unburnt carbon from vanadium containing ash and process the ash material to obtain metallurgical and chemical grade vanadium product. Separation of carbon was achieved using flotation technique. Development of vanadium recovery flowsheet includes evaluation of leaching, liquid-solid separation, solution treatment, product recovery and caustic recycle. Results showed a maximum vanadium recovery for decarbonized ESP (electrostatic precipitators) flyash at 93.3% at 800 kg NaOH/t, 200^{degree}C, 10% solids and 1 hour duration. Eluate obtained with hydrochloric acid was precipitated with ammonium hydroxide at pH 2.5 to produce a red cake having the following composition: 51.6% vanadium, 0.038% molybdenum, 0.07% silicon, <0.01% aluminum and 0.03% sulfur. 2 refs., 8 figs., 3 tabs.

0407 Health and Safety

Refer also to citation(s) 43780, 43781

0408 Economic, Industrial, and Business Aspects

Refer also to citation(s) 44462

43902 (AOSTRA–012095) **Welcome to oilsands valley! An address to the AOSTRA technology transfer sale, March 15, 1988, Calgary, Alberta.** Strom, N.A. (Energy Resources Conservation Board, Calgary, AB (Canada)). Alberta Oil Sands Technology and Research Authority, Edmonton, AB (Canada). 15 Mar 1988. 19p. (CE–03081). Source: Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: PRICES UPON REQUEST.

There will be a growing demand for large additional oil supplies from Alberta's oilsands. These sources will outstrip conventional sources within the next decade and have the prospect of becoming one of the great oil supply sources for the industrial trading nations. These sources of oil can be economically realized through rapid transfer of selected technologies from invention to bench-scale to field demonstration and then to commercial application. 4 refs., 3 figs., 2 tabs.

0409 Waste Management

43903 (ZE–C0874074) **Investigation of the use of porous membranes for the treatment of crude oil emulsions: Final report.** Zenon Environmental, Inc., Burlington, ON (Canada). May 1989. 94p. Contract EMR 23440-7-9169/01-SQ. (MICROLOG–90-03963). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The objective of this study was to make an assessment of the technical feasibility of treating water-in-oil emulsions from in-situ bitumen/heavy oil recovery operations using porous membranes. The objective of treatment is to remove the water from the oil to meet product quality specification. The feasibility of two approaches to treatment of water-in-oil emulsions using porous membranes was evaluated. In the oil permeation process, oil is driven through the membrane, while the water in the emulsion is retained and concentrated on the feed side of the membrane. In the evaluated water permeation process, the water-in-oil emulsion is destabilized by removal of salts and surfactants. In this process, water and caustic are added to the water-in-oil emulsion to produce an oil-in-water emulsion and then the water together with extracted salts and surfactant is removed by porous membrane filtration. It is shown the ultrafiltration of water-in-crude oil emulsions can reduce water concentrations in the oil permeate from up to 20% water to less than 0.5% water. Unfortunately, due to the high viscosities of water-in-crude oil emulsions, the flux rates are so low that the process is not technically feasible. Ultrafiltration of oil-in-water emulsions formed by the addition of water and caustic to a water-in-crude oil emulsion was shown to be ineffective for extracting the surfactants and salts and producing a clean water-free oil. However, testing has proven that ultrafiltration membranes can maintain a high flux while effectively removing water from an oil-in-water emulsion containing very high concentrations of oil (up to 60%). 2 refs., 16 figs, 33 tabs.

0410 Environmental Aspects

Refer also to citation(s) 43780

43904 Trace element mineral transformations associated with hydration and recarbonation of retorted oil shale. Essington, M.E. (Univ. of Wyoming Research Corp., Laramie (USA)). *Environmental Geology and Water Sciences (USA),* 13(1): 59-66 (Jan-Feb 1989). DOE Contract FC21-83FE60177.

A laboratory study was conducted to evaluate the influence of hydration and recarbonation on the solid-phase distribution of trace elements in retorted oil shale. Trace elements examined in this study were found to reside predominantly in the HNO_3-extractable and residual fractions. Hydration of retorted oil shale resulted in a shift in the majority of trace elements from residual to extractable forms. Cobalt, nickel, and zinc extractabilities were not significantly influenced by hydration, whereas antimony increased in the residual fraction. Subjecting retorted oil shale to atmospheric (0.033%) and 10% CO_2(g) levels over a nine-month equilibration period resulted in partial and full recarbonation, respectively. As the influence of recarbonation increased, trace elements reverted to residual forms. Vanadium, chromium, copper zinc, antimony, and molybdenum in the 10% CO_2(g) recarbonated material were more

resistant to sequential extraction than in retorted oil shale, whereas strontium, barium, and manganese were less resistant to sequential extraction. The extractabilities of cobalt, nickel, and lead were not affected by recarbonation. A significant result of this study was that the mineralogical residencies of trace elements in retorted oil shale were altered in response to conditions that may be present in a disposal environment. Thus, the long-term release of trace elements in retorted oil shale disposal environments may not be adequately predicted by applying the toxicity characteristic leaching procedure (TCLP). 35 refs., 3 tabs.

05 NUCLEAR FUELS

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 43897, 43930

43905 (PB–90-240383/XAB) **Diagenesis and uranium mineralization of the Lower Tertiary Kootznahoo Formation in the northern part of Admiralty Trough, Southeastern Alaska. Bulletin.** Dickinson, K.A.; Vuletich, A. Geological Survey, Denver, CO (USA). 1990. 18p. (USGS-BULL–1888). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card No. 89-600227.

The Lower Tertiary Kootznahoo Formation, a clastic unit, crops out in scattered areas in the Admiralty Trough, southeastern Alaska. The formation consists mainly of arkosic sandstone, conglomerate, and lesser amounts of coal and shale. Samples were collected and outcrops described from three main outcrop localities in an area beginning in the Kootznahoo Inlet area on the west-central side of Admiralty Island and extending southward to the Keku Strait area between Kuiu and Kupreanof Islands. X-ray diffraction, optical mineralogy, scanning electron micrographs, and stable isotope and other chemical analyses were utilized during sample studies. Three stages of diagenesis were recognized. Stage II was characterized by local uplift of the formation and the entrance of oxygenated meteoric ground water, which resulted primarily in kaolinization. Uranium mineralization associated with carbonaceous material has been found only where diagenesis to stage II has occurred.

0504 Feed Processing

Refer also to citation(s) 43908

43906 (CEA-R–5514) **Synthesis of uranium-plutonium mononitride through oxides reduction.** Bardelle, P. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Aix-Marseille-3 Univ., 13 - Marseille (France). 1988. 132p. (In French). Order Number DE90514566. Source: NTIS (US Sales Only), PC A07/MF A01.

Among the non-oxide ceramics, the nitrides exhibit substanding physical properties. With a good thermal conductivity and a high density, (U,Pu)N could favourably replace the oxide-type fuel which is used in fast breeder reactors. For economical reasons, the (U,Pu)N synthesis is carried out by the carbothermic reduction of the U and Pu oxides under flowing nitrogen. Mixing hydrogen in nitrogen at the end of the reaction allows to complete the nitride conversion. The residual contamination in oxygen is about 400.10^{-6} g per g (U,Pu)N and the carbon residual is about 600.10^{-6} g per g (U,Pu)N. Mass spectrometry measurements of the reacted gas support strongly the so far unexplained mechanism of an heterogeneous gas-solid catalysis reaction with a cyanhydric acid formation. After pelletizing by uni-axial compaction and natural sintering, the product presents such good characteristics that two irradiations of this new fuel have been carried out in the Phenix FBR. To satisfy the requirements of these two experiments, the sintered pellets show different densities, carbon and oxygen impurities. The densities vary from 81% of the theoretical density to 84%. The purest nitrides contain 600.10^{-6} in oxygen and 100.10^{-6} in carbon.

0505 Uranium Enrichment

Refer also to citation(s) 43908, 44438

43907 (POEF-T–3535) **Laboratory feasibility studies on control of tungsten contamination in Portsmouth VHE product.** Orlett, M.J. Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div. 20 Jul 1990. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00001. Order Number DE90016194. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Portsmouth very highly enriched (VHE) uranium hexafluoride (UF_6) contains varying amounts of tungsten hexafluoride (WF_6) as an undesirable contaminant. At desired production levels of VHE product, the WF_6 content often leads to rejection of the product. A laboratory project examining methods of separating low- level WF_6 from UF_6 has identified an apparently feasible method of separation. The contaminated UF_6 is sublimed through a series of progressively colder traps. Preliminary studies show that about 90 percent of the UF_6 may be caught in the first cold trap at about one-tenth the original WF_6 concentration. The second cold trap retains most of the remaining 10 percent of the UF_6 at several times the original WF_6concentration. The second cold trap retains most of the remaining 10 percent of the UF_6 at several times the original WF_6 concentration. A third, very cold trap removes the remaining UF_6 and WF_6. Further laboratory work to optimize this method is underway. 2 refs., 3 figs.

0507 Fuels Production and Properties

Refer also to citation(s) 43914, 43988, 44015, 44221, 44222, 44236, 44278, 44853

43908 (BMU–1989-240) **Data and information on foreign nuclear fuel reprocessing plants.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Mester, W. Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.). May 1988. 322p. (In German). Contract BMU SR 315/1. (GRS-A–1441). Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Data and information on foreign nuclear fuel reprocessing plants are assessed and compiled in a clear, concise form. The report presents the user with a sound review of plants carrying out conversion, uranium enrichment and fuel element preparation around the world. In case it is needed, a quick, preliminary set of facts has been prepared, on the basis of which (e.g. using the quoted sources) further research can be carried out if required. The assessment and evaluation of particular incidents in these plants is also made easier. (HP).

43909 (ETDE-IT–90-49) **Application of robotic systems to a fuel fabrication plant.** Mataloni, P. ENEA, Trisaia (Italy). Centro Ricerche Energia. Jul 1988. 8p. (CONF-880752–5: International symposium on teleoperation and control, Bristol (UK), 12-15 Jul 1988). Order Number DE90514524. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the international symposium on teleoperation and control (Bristol, 11-13 Jul 1988).

The application of robotic systems to a Fuel Fabrication Plant concerns both processing activities and extraroutine operations; processing activities can be automated in an industrial manner; a servomanipulator is more suitable for unusual operations. This paper deals with planning criteria pertinent to the subject; the preliminary design of a Testing Station and the planned experimental activities are also described.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 43923, 43938, 43941, 43942, 43944, 44012, 44313, 44952

43910 (CEA-CONF–9982) **Investigations of actinides complexes with dibutyphosphate.** Livet, J.; Musikas, C.; Vitart, X. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92

(France). Dept. de Genie Radioactif. 1989. 3p. (CONF-8903236–: 19. Actinides Meeting, Madonna di Campiglio (Italy), 29-31 Mar 1989). Order Number DE90514741. Source: NTIS (US Sales Only), PC A02/MF A01.

Larger insights into the chemical reactions between the actinides and the dibutylphosphate (DBP) ions are necessary because of the drawbacks due to the precipitation of metallic compounds of DBP^- during the PUREX process. The precipitation of the Th(IV)-DBP compounds and Th(IV)U(VI) mixture, from aqueous or organic (30% TBP into dodecan) has been investigated. The NO_3^- ions concentration plays an important role since mixed NO_3^--DBP^- complexes are often observed in the solids. Five compounds have been characterized by X-Ray diffraction and 31 P NMR.

43911 (CEA-CONF–9983) **Investigations of actinides complexes for the separation chemistry.** Musikas, C.; Livet, J.; Condamines, N.; Castelli, B. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1989. 3p. (CONF-8903236–: 19. Actinides Meeting, Madonna di Campiglio (Italy), 29-31 Mar 1989). Order Number DE90514650. Source: NTIS (US Sales Only), PC A02/MF A01.

The present communication examines (1) the complexes of tetravalent actinides in aqueous nitric solutions and in organic TBP - dodecane solutions and in particular the chemistry and solubility of thorium and uranyl complex with DBP; (2) N,N - dialkylamides as TBP substitutes for actinide separation and (3) replacement of DTPA by DTPP (diethylenetriaminopentaproponic acid) to form chelates for actinide decorporation.

43912 (CONF-900809–1) **Iodine and NO_x behavior in the dissolver off-gas and IODOX [Iodine Oxidation] systems in the Oak Ridge National Laboratory Integrated Equipment Test facility.** Birdwell, J.F. Oak Ridge National Lab., TN (USA). [1990]. 29p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From 21. DOE/NRC nuclear air cleaning conference; San Diego, CA (USA); 13-16 Aug 1990. Order Number DE90015160. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper describes the most recent in a series of experiments evaluating the behavior of iodine and NO_x in the Integrated Equipment Test (IET) Dissolver Off-Gas (DOG) System. This work was performed as part of a joint collaborative program between the US Department of Energy and the Power and Nuclear Fuel Development Corporation of Japan. The DOG system consists of two shell-and-tube heat exchangers in which water and nitric acid are removed from the dissolver off-gas by condensation, followed by a packed tower in which NO_x is removed by absorption into a dilute nitric acid solution. The paper also describes the results of the operation of the Iodine Oxidation (IODOX) System. This system serves to remove iodine from the DOG system effluent by absorption into hyperazeotropic nitric acid. 7 refs., 11 figs., 10 tabs.

43913 (ENEA-RT-COMB–89-21) **Synthetic schematic hydrogeological investigation of ENEA EUREX reprocessing plant site in Saluggia, Italy (groundwater mapping model).** Chiado' Rana, M.; Hall, A.; Fontanive, A:; Magri, G. ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile; ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Dec 1989. 18p. (In Italian). (RT/COMB–89-21). Order Number DE90514473. Source: NTIS (US Sales Only), PC A03/MF A01.

This report gives the description based on previous data, of the hydrogeology of the region where the ENEA (Italian Commission for Alternative Energy Sources) EUREX reprocessing plant site is located and sketches out a profile of the circulation of the underground waters. A layout is included of the network to measure the phreatic levels and those of the superficial waters, in order to get experimental data necessary for the development of a numerical model to describe the site hydrogeology.

43914 (ETDE-IT–90-18) **Some findings in the neutron multiplication factor monitoring.** Landeyro, P.A.; Zoltowski, T. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. 1989. 23p. Order Number DE90514495. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Nuclear Science and Engineering.

The aim of this research was to study the monitoring of the effective multiplication factor (Keff)in some steps of fissile material processing plants. Two sets of experimental tests were performed. In the first one, variable gradients of concentration were modelled, while in the second one (uniform) the tank was filled at different levels with a uranyl-nitrate solution having 45g U/l (80 wt% enriched in U235). Another series of uniform configurations was calculated to cover a range of Keffnot far from criticality. In the last computations, all the calculational models were used in order to represent experiments in which only the source position changes from the axis of the set-up to a position 0.5 cm outside the external surface of the tank. The Keff calculations were performed with the Keno 4 Monte Carlo code. The flux computations were carried out with the Morse C.G. code. The previously established dependence between infinite K and Mepi, was used for the analysis of experimental and calculational tests. Excellent agreement between measured and calculated or epithermal neutron multiplication values was found. The agreement between Keff values obtained from the measured and calculated epithermal neutron multiplication data and Keno 4 results improved with increasing Keff values.

43915 (ETDE-IT–90-48) **Technical and commercial aspects of European MTR reprocessing.** Pozzi, F.; Risoluti, P.; Rolandi, G. ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile; ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Jul 1987. 13p. (CONF-8707226–1: International conference on nuclear fuel reprocessing waste management - RECOD '87, Paris (France), 23 Jul 1987). Order Number DE90514523. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the international conference on nuclear fuel reprocessing waste management - RECOD'87 (Paris, 23-27 Aug 1987).

The storing capacity of materials test and research (MTR) reactors usually does not exceed the discharge corresponding to one or two years operation at nominal power. Reprocessing of spent fuel is therefore a routine need and practice for reactor operators. In this review of the technical and commercial aspects of European MTR reprocessing, reprocessing demand and availability for European countries, along with the operational experience gained with the EUREX plant of ENEA (Italian Commission for Alternative Energy Sources) is considered. Although the EUREX plant has operational and technical capabilities for reprocessing MTR fuels, providing services for fuel discharged from European reactors cannot be easily envisaged nor established on sufficiently regular basis, due to already planned activities. Finally, the existing storage capacity of the liquid HLW cannot allow the start, on regular basis, of MTR fuels reprocessing; an increase of this capacity is yet under investigation.

43916 (ETDE-IT–90-59) **The extraction of Eu(3) from acid media by octyl(phenyl)-N, N-diisobutylcarbamoylmethylphosphinoxide.** Liansheng, Wei; Casarci, M.; Gasparini, G.M. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. 1989. 23p. Order Number DE90514533. Source: NTIS (US Sales Only), PC A03.

Published on Solvent Extraction and Ion Exchange.

Relevant to research on the decontamination of aqueous wastes from nuclear fuel reprocessing, the extraction behaviour of Eu(3) from nitricand hydrochloric acid by solutions of octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide (CMPO), with and without tributyl phosphate (TBP), was studied by using mesitylene and dodecane as diluents. Compared with CMPO alone, the CMPO-TBP mixture showed a slight enhancement in the extraction of Eu(3) from nitric acid above 2M and lower Eu(3) distribution ratios (DEu s) from low acidity. The distribution ratios measured for Eu(3) between nitric acid and CMPO-TBP in dodecane were higher than the corresponding values in mesitylene. Extractant dependency studies in the presence and absence of TBP showed that at low nitric acid concentrations, the extractant dependency curve obtained in the presence of TBPlay below the curve obtained in the absence of TBP. At high acidity, the opposite was observed. The extraction of Eu(3) from hydrochloric acid by CMPO-TBP in dodecane was much lower than from nitric acid. A comparison between CMPO and D2EHPA for Eu(3) extraction is reported in this paper.

43917 (JAERI-M-90-016) **Outline of an experimental apparatus for the study on the advanced voloxidation process.** Uchiyama, Gunzo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sugikawa, Susumu; Maeda, Mitsuru; Tsujino, Takeshi; Torikai, Seishi; Kitamura, Masafumi; Yamazaki, Kazunobu. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. 75p. (In Japanese). Order Number DE90513754. Source: NTIS (US Sales Only), PC A04/MF A01.

The experimental apparatus (VULCAN, the capacity; 2 kg-UO_2/batch) was constructed to study on the advanced voloxidation process, which was proposed to reduce amount of tritium released from fuel reprocessing facilities. Using this equipment, a process study was conducted on behaviors of oxidation-reduction of simulated fuels and of release of tritium, and on confinement function of rotary seal of the reactor. An outline of the experimental apparatus is described. (author).

43918 (LA-UR-90-2255) **Pyrochemical neutron multiplicity counter design.** Langner, D.G.; Ensslin, N.; Krick, M.S. Los Alamos National Lab., NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9007106-47: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015099. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Pyrochemical process materials are difficult to measure using conventional neutron counting methods because of significant self-multiplication and variable (α,n) reaction rates. Multiplicity counters measure the first three moments of the neutron multiplicity distribution and thus make it possible to determine sample mass even when multiplication and (α,n) rate are unknown. A new multiplicity counter suitable for inplant measurement of pyrochemical process materials has been designed using Monte Carlo simulations. The goals were to produce a counter that has high neutron detection efficiency, low die-away time, a flat spatial efficiency profile, and is insensitive to the neutron energy spectrum. Monte Carlo calculations were performed for several prototype models consisting of four rings of 71-cm active length ^{3}He tubes in a polyethylene body. The cadmium-lined sample well is 25 cm in diameter to accommodate a wide variety of inplant sample containers. The counter can be free-standing or in-line without mechanical modification. The calculations were performed to determine the above design criteria for several configurations of tube spacing, cadmium liners, and sample height. Calculations were also performed for distributed sample sources to understand the integrated effects of variable neutron spectra on the counter. 5 refs., 8 figs., 1 tab.

43919 (RFP-4412) **Plutonium inclusion analysis.** Reifenberg, D.H. EG and G Rocky Flats, Inc., Golden, CO (USA). 1 Nov 1986. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE90015674. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A series of plutonium samples from the direct oxide reduction process was received from Process Chemistry. Two specimens were selected for analysis: a tantalum stirrer that was above the plutonium metal, and a tantalum stirrer that was immersed in the plutonium metal.

0509 Transport, Handling, and Storage

Refer also to citation(s) 44003, 44013, 44973, 46299

43920 (BNL-52233) **Modeling status and needs for temperature calculations within spent fuel disposal containers.** Sullivan, T.M.; Pescatore, C. Brookhaven National Lab., Upton, NY (USA). Oct 1989. 39p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC02-76CH00016. Order Number DE90014842. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Brookhaven National Laboratory (BNL) Waste Materials and Environment Modeling (WMEM) Program has been assigned the task of helping the DOE formulate and certify analytical tools needed to support and/or strengthen the Waste Package Licensing strategy. One objective of the WMEM program is to perform qualitative and quantitative analyses of processes related to the internal waste package environment, e.g., temperature, radiolysis effects, presence of moisture, etc. The primary objective of this report is to present the findings of a literature review of work pertinent to predicting intact waste package internal temperatures under spent fuel isolation conditions. Therefore, it is assumed that a repository scale thermal analysis has been conducted and the exterior temperature of the waste package is known. Thus, the problem reduces to one determined by the waste package and its properties. Secondary objectives of this report are to identify key parameters and methodologies for performing the thermal analysis within intact waste containers, and identify sources of uncertainty in these calculations. 37 refs., 6 figs., 2 tabs.

43921 (CEPN-138) **Plutonium transport for the oxide form. Air and road accidentology.** Degrange, J.P.; Hubert, P.; Pages, P. Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France). Jul 1989. 142p. (In French). Contract BC-3648. Order Number DE90514563. Source: NTIS (US Sales Only), PC A07/MF A01.

The aim of the study is to define the probability of accident that can be applied to a packaging for plutonium oxide transport. The analysis is designed essentially for packagings of few tons with impact resistance corresponding to a speed of 10 m/s but can be used for packagings with a resistance corresponding to IAEA tests. This work is based on analysis and processing of 2 accident files: one on road accidents, the other on air accidents. Computer codes are developed, from one hand, to obtain stress indicator distribution by Monte Carlo methods and on the other hand to link these distributions to itinerary parameters. Previous similar studies are examined and compared to figures obtained here and explained as far as possible.

43922 (CONF-901075-2) **The development of an operations system for the transport of spent nuclear fuel in the United States Civilian Radioactive Waste Management Program.** Best, R.E. (Science Applications International Corp., Oak Ridge, TN (USA)); Danese, F.L.; Peterson, R.W.; Joy, D.S.; Pope, R.B.; Ratledge, J.E.; Shappert, L.B.; Wankerl, M.W.; Klimas, M.J.; Darrough, M.E. Oak Ridge National Lab., TN (USA). [1990]. 3p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From Spectrum '90; Knoxville, TN (USA); 3-5 Oct 1990. Order Number DE90011370. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In order to support the development of a Transportation Operations System for the Federal Waste Management System (FWMS) by the Office of Civilian Radioactive Waste Management, the United States Department of Energy formed the Transportation Project Office at its field office in Chicago. Planning and development activities are being performed in a number of areas including a major effort in operations support, providing the planning and assessment necessary for developing the future transportation operations capability needed by the FWMS. The purpose of this paper is to review significant planning and development accomplishments, and outline expected future efforts for the continued development, acquisition, test, and startup of the transportation operations component of the FWMS. 2 refs.

43923 (ETDE-IT-90-22) **Experience in the handling and transport of spent fuel after long term storage in pools of Enea's facilities.** Hall, A. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Sep 1989. 36p. (CONF-8908248-1: IAEA-Befast 2 meeting, Helsinki (Finland), 28 Aug 1989). Order Number DE90514497. Source: NTIS (US Sales Only), PC A03.

Paper presented at IAEA-Befast 2 meeting (Helsinki, 28 Aug-1 Sep 1989).

This report outlines the main features of the EUREX storage pool, describes the goals of the project, lists the facilities installed at the pool to handle the fuel and the transport flask and provides significant data relevant to the three shipments carried out to date. The report also includes information on the actual storage conditions of the fuel elements at the time of their transfer and a comparison with the estimated conditions. An appendix explains the experimental data and the theoretical assumptions used for the appraisal of the fuel storage conditions.

43924 (PB–90-239724/XAB) **Transportation of hazardous materials 1989.** Saccomanno, F.F.; Shortreed, J.H.; Van Aerde, M.; Higgs, J.; Abkowitz, M. National Research Council, Washington, DC (USA). Transportation Research Board. 1989. 74p. (TRB/TRR–1245). Source: NTIS, PC A04/MF A01.

See also report for 1988, PB–90-145582. Library of Congress catalog card No. 90-35157.

The 6 papers in the report deal with the following areas: Comparison of risk measures for the transport of dangerous commodities by truck and rail; Hazardous materials transport risk estimation under conditions of limited data availability; Characteristics of accidents and incidents in highway transportation of hazardous materials; Minimizing derailments of railcars carrying dangerous commodities through effective marshaling strategies; Combined location-routing model for hazardous waste transportation and disposal; Bicriterion routing scheme for nuclear spent fuel transportation.

43925 (PB–90-591160/XAB) **Hazardous Materiel Data File (HMDF), quarterly update. Data file.** Army Materiel Command, New Cumberland, PA (USA). Catalog Data Activity. 1 May 1990. mag ta Source: NTISSubscription.

Supersedes PB–89-924700. Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Available on subscription, NAC price $880/year; individual issue $220; all others write for quote. Issued quarterly.

The Hazardous Materiel Data File (HMDF) purpose is to provide storage and transportation information on chemical, radioactive and ammunition items in the Army inventory. Data are taken from the Army Central Logistics Data Bank (ACLDB).

43926 (PNL-SA–18010) **Assessing waste storage and transport alternatives based on multiple performance measures.** Holter, G.M.; Shay, M.R.; Stiles, D.L. Pacific Northwest Lab., Richland, WA (USA). Mar 1990. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900676–11: 83. annual meeting and exhibition of the Air and Waste Management Association, Pittsburgh, PA (USA), 24-29 Jun 1990). Order Number DE90016340. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Planning for future waste storage and transport is becoming an increasingly important task. There is a continual growth in regulatory requirements relating to waste management activities such as storage and transport. In addition, increasing demand for these services accentuates the need for proper planning, to ensure that needed services can be obtained when the time comes. At Pacific Northwest Laboratory (PNL), we have been involved in a variety of efforts to develop improved mechanisms to support planning for waste management needs, including waste storage and transport. This paper discusses one of these areas. 1 fig., 1 tab.

43927 (WHC-SA–0815) **Radioactive solid waste handling at the Plutonium Finishing Plant.** Manthos, E.J. Westinghouse Hanford Co., Richland, WA (USA). May 1990. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-901075–3: Spectrum '90, Knoxville, TN (USA), 3-5 Oct 1990). Order Number DE90011933. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Plutonium Finishing Plant is located on the Hanford Site in the southeast section of Washington State. It has been in operation since 1949. The mission of the plant is to produce plutonium metal and related products for the US Department of Energy defense programs. Solid transuranic, low-level, and mixed wastes are generated at the plant, the radioactive contaminants in the waste being primarily alpha emitting. This paper discusses present waste-handling methods at the plant and recent changes that were made to improve waste characterization. 2 refs.

43928 Feasibility and incentives for burnup credit in spent-fuel casks. Sanders, T.L. (Sandia National Labs., Albuquerque, NM (USA)); Westfall, R.M. *Nuclear Science and Engineering (USA)*, 104(1): 66-77 (Jan 1990).

The spent-fuel carrying capacities of previous-generation spent-fuel shipping casks have been primarily thermal and/or shielding limited. Shielding and heat transfer requirements for casks designed to transport older spent fuel with longer decay times are reduced considerably and cask capacities become criticality limited. Using burnup credit in the design of future casks can result in increased cask capacities as well as reduced environmental impacts and savings in time and money.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 43776, 43948, 43949

43929 (DOE/EM–0004P) **Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1989: Report to Congress in response to Public Law 99-240.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (USA). Jun 1990. 16p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE90016658. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This response is submitted in response to the Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act), Public Law 99-240. The report summarizes expenditures made during the calendar year 1989 of surcharge rebates from the July 1, 1986, milestones. Title I of the Act requires the Department of Energy (DOE) to administer a Surcharge Escrow Account. This account consists of a portion of the surcharge fees paid by generators of low-level radioactive waste in nonsited compacts (regional compacts currently without operating disposal sites) and nonmember States (States without disposal sites that are not members of compacts) to the three States with operating disposal facilities (Nevada, South Carolina, and Washington) (sited States) for using their disposal facilities. In administering the Surcharge Escrow Account, the Act requires DOE to: invest the funds in interest-bearing United States Government securities; determine eligibility of rebates of the funds by evaluating State and compact progress toward developing new disposal sites against milestones set forth in the Act; disburse the collected rebates and interest; assess compliance of rebate expenditures with the limitations prescribed in the Act; and submit a report annually to Congress summarizing rebate expenditures by States and regions. 5 tabs.

43930 (PB–90-232463/XAB) **Minerals yearbook, 1988: Thorium.** Hedrick, J.B. Bureau of Mines, Washington, DC (USA). 1988. 10p. Source: NTIS, PC A02/MF A01.

Also available from Supt. of Docs.

Mine production of monazite, the principal source of thorium, decreased slightly in 1988. Associated Minerals (USA) Inc. was the only domestic monazite producer. Monazite produced in the United States was exported, and the thorium products used domestically were derived from imported materials, existing company stocks, and thorium nitrate released from the National Defense Stockpile. Major nonenergy uses were in refractory applications, ceramics, and mantles for incandescent lanterns. The only energy use of thorium in the United States was in the high-temperature gas-cooled (HTGC) nuclear reactor at Fort St. Vrain, CO. Topics discussed in the report include domestic data coverage, legislation and government programs, domestic production, consumption and uses, stocks, prices, foreign trade, world capacity, and world review–(Australia, Brazil, Madagascar, Mozambique).

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Refer also to citation(s) 43847, 43918, 43926, 43927, 43929, 44004, 44007, 44011, 44362, 44428, 44435, 44440, 44450, 44631, 44854, 44877, 44924, 44970, 44971, 45095, 45165, 45347, 45348, 45651, 45904, 45929, 45930, 45988

43931 (ANL–90/21) **Strategy for experimental validation of waste package performance assessment.** Bates, J.K.; Abrajano, T.A. Jr.; Wronkiewicz, D.J.; Gerding, T.J.; Seils, C.A. Argonne National Lab., IL (USA). Jul 1990. 64p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-31109-ENG-38. Order Number DE90015839. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A strategy for the experimental validation of waste package performance assessment has been developed as part of a program supported by the Repository Technology Program. The strategy was developed by reviewing the results of laboratory analog experiments, in-situ tests, repository simulation tests, and material interaction tests. As a result of the review, a listing of dependent and independent variables that influence the ingress of water into the near-field environment, the reaction between water and the waste form, and the transport of radionuclides from the near-field environment was developed. The variables necessary to incorporate into an experimental validation strategy were chosen by identifying those which had the greatest effect of each of the three major events, i.e., groundwater ingress, waste package reactions, and radionuclide transport. The methodology to perform validation experiments was examined by utilizing an existing laboratory analog approach developed for unsaturated testing of glass waste forms. 185 refs., 9 figs., 2 tabs.

43932 (DOE/ID–10253) **Environmental Restoration and Waste Management site specific plan for DOE-ID: Overview.** USDOE Idaho Operations Office, Idaho Falls, ID (USA). Task Force. May 1990. 288p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC07-76ID01570. Order Number DE90015473. Source: NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The purpose of this site specific plan is to outline how the Environmental Restoration and Waste Management Five-Year Plan published in August 1989 by the Department of Energy (DOE) will be implemented at the DOE Idaho Operations Office (DOE-ID) sites. These sites include the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; Plasma Arc Research and Development Program in Butte, Montana; Monticello Millsite in Utah; Grand Junction Projects Office facilities in Grand Junction, Colorado; and West Valley Nuclear Services facilities near West Valley, New York. This overview encompasses activities and costs for corrective activities, environmental restoration, and waste management operations under the jurisdiction of DOE-ID. Corrective activities are those required to bring active and standby facilities into compliance with air, water and solid waste regulatory requirements and agreements. Environmental restoration is defined as those remedial actions required at all inactive/surplus facilities and sites contaminated with radioactive, hazardous, or mixed waste. Waste management operations are those connected with minimization, treatment, storage, and disposal of all radioactive, hazardous, mixed, and sanitary wastes generated as a result of ongoing operations at active facilities. 6 figs., 11 tabs.

43933 (DOE/ID–10273) **US Department of Energy Idaho Operations Office (DOE-ID) Waste Minimization Program Plan.** Klossner, K.; Gitt, M. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1990. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC07-76ID01570. (MISC–90085). Order Number DE90015467. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of the Waste Minimization Program Plan (WMPP) is to formalize, quantify, and direct waste minimization program activities at program sites under the jurisdiction of the US Department of Energy Idaho Operations Office (DOE-ID). These sites include the Idaho National Engineering Laboratory (INEL), Grand Junction Projects Office (GJPO), Component Development and Integration Facility (CDIF), and the West Valley Demonstration Project (WVDP). Each facility is required to review and revise their own waste minimization plans to implement the requirements of this Plan. Types of waste addressed by this Plan include radioactive, hazardous, mixed, and solid nonradioactive, nonhazardous. 2 figs., 2 tabs.

43934 (DOE/RL–88-20-Suppl.1) **Low-level burial grounds dangerous waste permit application: Request for exemption from lined trench requirements for submarine reactor compartments.** USDOE Richland Operations Office, WA (USA). Jul 1990. 209p. Sponsored by U.S. DOE Nuclear Energy. Order Number DE90015847. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

This document is submitted to request an exemption for Trench 94 from dangerous waste landfill liner and leachate collection and removal system (hereinafter referred to as liner/leachate system) requirements. This exemption request is based on an evaluation which demonstrates that burial in Trench 94 of cathodically protected submarine reactor compartments (SRC), which contain lead and polychlorinated biphenyls (PCB) as hazardous constituents, is as effective as disposal in a landfill having a liner/leachate system. This demonstration also considers the effectiveness of burial in Trench 94 in terms of preventing long-term migration of contaminants to groundwater or surface water. Modeling results indicate that release of contaminants to the groundwater or surface water will not occur until after long periods of time and that even after reaching the groundwater, contaminants will not be in excess of current regulatory limits, such as drinking water standards. Chapter 1.0 provides introductory information concerning this request, including the scope of the exemption request and relevant background information. The five subsequent chapters provide information needed to support the exemption request. Chapter 2.0 discusses the regulatory basis for the exemption request and presents performance objectives related to regulatory requirements. Chapter 3.0 provides a description of the site and its operation. Chapter 4.0 describes the wastes subject to this exemption request Chapter 5.0 discusses the performance of the disposal site with respect to performance objectives. Finally, Chapter 6.0 presents the actual request for exemption from requirements for a liner/leachate system. 30 refs., 13 figs., 6 tabs.

43935 (DOE/RW–0051P-Rev.1) **OCRWM Systems Engineering Management Plan (SEMP): Revision 1.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). Mar 1990. 48p. Sponsored by U.S. DOE Radioactive Waste Management. Source: OSTI (Free of Charge); INIS.

The Nuclear Waste Policy Act of 1982 established the Office of Civilian Radioactive Waste Management (OCRWM) in the Department of Energy (DOE) to implement a program for the safe and permanent disposal of spent nuclear fuel and high-level radioactive waste. To achieve this objective, the OCRWM is developing an integrated waste-management system consisting of three elements: the transportation system, the monitored retrievable storage (MRS) facility, and the mined geologic disposal system (MGDS). The development of such a system requires management of many diverse disciplines that are involved in research, siting, design, licensing, and external interactions. The purpose of this Systems Engineering Management Plan (SEMP) is to prescribe how the systems-engineering process will be implemented in the development of the waste-management system. Systems engineering will be used by the OCRWM to manage, integrate, and document all aspects of the technical development of the waste-management system and its system elements to ensure that the requirements of the waste-management program are met. It will be applied to all technical activities of the OCRWM program. It will be used by the OCRWM to specify the sequence of technical activities necessary to define the requirements the waste-management system must satisfy, to develop the waste-management system, to relate system elements to each other, and to determine how the waste-management system can be optimized to most effectively satisfy the requirements. Furthermore, systems engineering will be used in the management of Program activities at the program, program-element, and project levels by specifying procedures, studies, reviews, and documentation requirements. 9 refs., 1 fig.

43936 (EGG-WM–8949) **RWMC [Radioactive Waste Management Complex] vadose zone basalt characterization: FY 89 report.** Knutson, C.F. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); McCormick, K.A.; Smith, R.P.; Hackett, W.R.; O'Brien, J.P.; Crocker, J.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jul 1990. 426p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015420. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

The purpose of this study is to provide geologic data that can be used to construct a three-dimensional subsurface model of the vadose zone beneath the Radioactive Waste Management Complex (RWMC). The type of modelling effort that is envisioned is the development of hybrid stochastic simulation. A hybrid model is necessary because of the requirements to treat both discrete parameters, such as the geometry of individual flows, and continuous parameters, such as the permeability variation within a flow. The

procedures being used in this study are to: Review the general geologic picture to understand the paleoenvironment of the RWMC area, to Develop parameter distribution and variations through geostatistical studies of medial and distal facies of analogous flow units that are available for examination at Box Canyon and Hell's Half Acre, and to Carefully measure the lithologic and petrophysical parameter of the available cores taken during previous investigations at the RWMC. 21 refs., 61 figs., 10 tabs.

43937 (ENEA-RT-COMB–89-15) **Laboratory tests on the Italian BEL 15 reference glass.** Cantale, C.; Castelli, S.; Donato, A. ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Jan 1990. 62p. (RT/COMB–89-15). Order Number DE90514467. Source: NTIS (US Sales Only), PC A04/MF A01.

Contribution of ENEA CASACCIA to the Final Report of the EEC Research Contract n. FI1W/0100-B. Published also as SCK/CEN Mol (Belgium) N. R2752 June 1988.

The contribution of ENEA (Italian Commission for Alternative Energy Sources) to the Common Market R&D Programme on Radioactive Waste, Task 3, consisted of laboratory interaction tests of the Italian reference HLW (high-level radioactive waste) borosilicate glass BEL 15 both with Italian and Belgian clay media. A series of static leach experiments referring to the MCC-1 test were performed, using three different leaching media: distilled water, synthetic interstitial claywater and a mixture of clay and distilled water. The tests were carried out at 40 and 90 degrees C and with a surface area to solution volume ratio of 100 m_{-1}, at environmental atmospheric conditions. All the experiments were carried out using inactive and simulated glass samples. The leachates were analysed in terms of PH and cation composition; the results were reported as Mass Loss and Normalized Elemental Mass Loss. The surface analysis of the corroded samples were performed using SEM-EDAX and EMPA techniques.

43938 (ENEA-RT-COMB–89-16) **MTR liquid waste, contained in EUREX F-710/D storage tank, declassification tests.** Gasso, G.; Momo, S.; Pietrelli, L.; Troiani, F. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Dec 1989. 34p. (In Italian). (RT/COMB–89-16). Order Number DE90514468. Source: NTIS (US Sales Only), PC A03/MF A01.

In this report, the result of experimental tests performed with real liquid wastes from the reprocessing of MTR (materials testing reactors) nuclear fuel is reported. The aim of the research is to separate the actinides and long-life radioactive fission products from the bulk salt matrix of HLW (high-level wastes). Processes based on chemical precipitation and/or adsorption were studied by taking into account the chemical and radiochemical composition of the liquid wastes and using the radioactive waste sampled from the tank. The results show that decontamination factors of 100, 1000, 5000 were obtained for Sr, Cs and Pu respectively.

43939 (ENEA-RT-COMB–89-18) **Treatment of toxic and noxious organic wastes, by use of wet oxidation process, at boiling temperature (applications in nuclear field).** Piccinno, T.; Salluzzo, A.; Nardi, L.; Gili, M.; Luce, A.; Troiani, F.; Cornacchia, G. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile; ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile. Dec 1989. 51p. (In Italian). (RT/COMB–89-18). Order Number DE90514470. Source: NTIS (US Sales Only), PC A04/MF A01.

The wet oxidation process, using air or molecular oxygen, is a well-known process, suitable for the oxidation of several types of waste refractory in the usual biological, thermal and chemical treatments. The drastic operating conditions (high pressures and temperatures) prevented its industrial development. Recently, research is being conducted to verify the feasibility of the process in the treatment of nuclear wastes (organic resins and exhaust organic wastes); the treatment is being tested at widely reduced operating conditions (atmospheric pressure and boiling temperature) by means of metallic catalyst and hydrogen peroxide. With some limitations, wet oxidation with hydrogen peroxide at low temperature can be applied to conventional waste waters containing toxic organic compounds. This report summarizes the activities being carried out at the ENEA (Italian Commission for Alternative Energy Sources) Fuel Cycle Dept. by the task force 'Deox' constituted by laboratory and plant specialists who are verifying the application of the wet oxidation process in the treatment of toxic wastes.

43940 (ENEA-RT-COMB–89-19) **Behaviour of the Italian BEL 15 borosilicate glass incorporating MTR HLW with reference to the disposal in clay formations.** Cantale, C.; Castelli, S.; Donato, A.; Guidi, G. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base. Dec 1989. 14p. (CONF-8908249–1: 9th international clay conference A.I.P.E.A, Strasbourg (France), 28 Aug 1989; RT/COMB–89-19). Order Number DE90514471. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at 9th international clay conference A.I.P.E.A. (Association Internationale pour l'etude des argiles). Strasbourg, 28 Aug-2 Sep 1989.

About 84 cubic meters of MTR (Materials Testing Reactors) high level wastes (HLW), generated by the Eurex Reprocessing Pilot Plants were stored in stainless steel tanks. Although the radioactivity of these wastes, (2.44 Ci/l as beta-gamma and 1.41 E-03 Ci/l as alpha), is lower than that of HLW arising from LWR fuel reprocessing, their alpha content and specific activity necessitate their vitrification directly, or after a selective separation process of the radioactive isotopes. For the direct vitrification of the MTR HWL a borosilicate glass composition, named BEL 15 was selected. This paper reports some results from a BEL 15 characterization study. The study was performed with reference to underground disposal in a clay formation. MCC-1 type static leach tests were carried out using three different leaching media at 40 C and 90 C, and at two SA/V ratios: 10 and 100 m^{minus1}. A laboratory simulation of direct clay-glass contact was carried out, using a specially designed set-up, with contact time up to 4 months. Some preliminary results are reported.

43941 (ENEA-RT-COMB–89-20) **SERSE pilot plant: Description and results of experimental tests on the chemical treatment of a simulated liquid waste.** Calle, C.A.; Gili, M.; Luce, A.; Marrocchelli, A.; Pietrelli, L.; Troiani, F. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Dec 1989. 83p. (In Italian). (RT/COMB–89-20). Order Number DE90514472. Source: NTIS (US Sales Only), PC A05/MF A01.

Chemical processes (precipitation and/or adsorption) for the selective separation of actinides and long-life fission products from aged liquid wastes are described. The SERSE pilot plant is a cold facility which was designed, by ENEA (Italian Commission for Alternative Energy Sources), for the engineering scale demonstration of the chemical separation processes to be applied to wastes stored at the EUREX facility at Saluggia, Italy. The experimental tests carried out in the plant are described and the results confirm the laboratory data. The elaboration of the experimental data has allowed the possibility of obtaining important clarifications on the treatment of highly saline liquid wastes.

43942 (ETDE-IT–90-29) **Sol-gel process development at fuel cycle department of ENEA, Italy.** Vatteroni, R. ENEA, Casaccia (Italy). Centro Ricerche Energia. Nov 1989. 5p. (CONF-8910120–1: 1. international ceramic science and technology congress, Anaheim, CA (USA), 31 Oct - 3 nov 1989). Order Number DE90514505. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 1st international ceramic science and technology congress (Anaheim, 31 Oct-3 Nov 1989).

This paper examines the feasibility of the use of the Sol-Gel technique in the preparation of granular precursors of inorganic ion exchangers for processing medium activity wastes; SYNCROC (a thermodynamically stable mixture to reproduce a natural rock structure capable of absorbing almost all radionuclides) for the immobilisation of highly active wastes; ceramic superconductors at high critical temperatures. In comparison with traditional methods for the production of ceramics, the Sol-Gel process seems to allow for a stricter microstructural control with particular respect to the stoichiometry (both on a micro and macro scale), to the dimensions of grains and the crystallographic structure, in that: the high grade of homogeneity, also at the molecular level, due to the mixture of the initial elements in a liquid phase, gives a well defined and reproducible stoichiometry at the end of the process; the high grade of reactivity of the particulate, due to its high specific

surface, allows for shorter thermal cycles; the high grade of homogeneity of the particulate renders unnecessary the processes of grinding and mixing during the entire cycle.

43943 (ETDE-IT–90-40) **A hot-cell facility for waste management studies at the J.R.C. Ispra establishment (Italy).** Hunt, B.A.; Dworschak, H.; Bertelli, S.; Magni, G.; Girardi, F.; Nannicini, R. Commission of the European Communities, Ispra (Italy). Joint Research Centre. Jun 1989. 4p. (CONF-890544–1: 2. International conference on radioactive waste management, Brighton (UK), 2-5 May 1989). Order Number DE90514516. Source: NTIS (US Sales Only), PC A02.

Paper presented at the conference on radioactive waste management (Brighton, 2-5 Jun 1989).

The hot-cell facility, constructed and commissioned at the Joint Research Centre of the European Communities, Ispra (Italy), will be utilised for research on radioactive waste management with emphasis on verification, demonstration and optimization of concepts already under study. The facility will produce various types of fully active waste in order to verify potentially suitable process modes to minimize waste production and improve waste quality in function of both effectiveness and safety of final disposal.

43944 (ETDE-IT–90-56) **The extraction of Eu(3) from nitric and hydrochloric acid solutions by mixtures of CMPO and TBP in dodecane.** Liansheng, Wei; Gasparini, G.M. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. 1989. 22p. Order Number DE90514530. Source: NTIS (US Sales Only), PC A03/MF A01.

Stage from 1 May 1988 to 30 April 1989 in the frame of the bilateral agreement between ENEA (Italy) and People Republic of China.

Carbamoylmethylphosphine oxide (CMPO) is an interesting tool for the decontamination of aqueous waste coming from nuclear fuel reprocessing and/or from fuel fabrication facilities. In the research work described in this paper, the extraction of Eu(3) from nitric and hydrochloric acid solutions by means of mixtures of CMPO and tributylphosphate (TBP) was studied with the use of dodecane as diluent. Mixed CMPO-TBP showed high distribution ratios for Eu(3)from nitric acid solutions above 1.0M nitric acid and lower Eu(3) distribution ratios (DEu) at lower acidities. The extractant dependency of the DEu was studied by varying the CMPO concentration in the presence of a fixed concentration of TBP. Power extractant dependencies of 2.0 and 2.5 for DEu were observed over a range of CMPO concentrations from 0.05 0.5M when the extractions were performed from 0.1M and 2.7M nitric acid respectively.The TBP/CMPO ratio showed great influence on the phase compatibility. The effect of Eu content on its extraction was investigated. Comparison of Eu(3) extraction from nitric and hydrochloric acid by mixtures of CMPO and TBP in dodecane was also carried out. The distribution ratios of Eu(3) obtained from hydrochloric acid were much lower than from nitric acid.

43945 (FMPC–2202) **Challenges in concepts and strategic planning for environmental cleanup at US Department of Energy facilities.** Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center. [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-86OR21600. (CONF-9010153–1: Project management institute seminar/symposium, Clagary (Canada), 17 Oct 1990). Order Number DE90014469. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Feed Materials Production Center (FMPC) is a large scale, integrated facility designed to produce uranium metal products used as feed materials in the US Department of Energy (DOE) defense programs. The FMPC is implementing strict modern standards for health, safety and environmental protection. All upgrades, improvements and cleanup efforts are designed to bring the facility in line with current day standards and regulations. The DOE has embarked on a major environmental cleanup program at the FMPC in conjunction with the US Environmental Protection Agency (USEPA) and the Ohio Environmental Protection Agency (OEPA). This program is part of a concentrated nationwide effort by the DOE at all its facilities to achieve compliance with laws, regulations, and agreements aimed at protecting human health and the environment. DOE is focusing its resources to assess and clean up inactive waste sites and facilities, continue safe and effective waste management operations but emphasize systematic minimization of waste generation, and coordinate an aggressive applied waste research and development (R&D) program keyed to developing innovative environmental technologies to yield permanent disposal solutions and lower costs. This paper deals with the environmental restoration facet of the five-year plan and how it specifically relates to cleanup activities at the FMPC. 5 figs.

43946 (FMPC–2214) **Environmental restoration and waste management site specific plan.** Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center. Jul 1990. 119p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-86OR21600. Order Number DE90015704. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Feed Materials Production Center (FMPC) is located in southwestern Ohio, approximately twenty miles northwest of downtown Cincinnati near the communities of Miamitown and Ross, Ohio. The FMPC is owned by the US Department of Energy (DOE), managed by the Oak Ridge Operations (ORO) Office, and operated by the Westinghouse Materials Company of Ohio (WMCO). The FMPC was built by the US Atomic Energy Commission to establish an in-house integrated production complex for processing uranium and its compounds from natural uranium ore concentrates. A wide variety of chemical and metallurgical process steps are utilized to support the manufacturing of uranium metal products that began in 1953. Site modifications since then have not resulted in significant expansion of the approximately 300 acres originally established for production and waste management purposes. One of the FMPC's function has been to produce purified depleted uranium metal for use at the Oak Ridge Y-12 Plant and the Rocky Flats Site. The feedstock for uranium metal production comes primarily from uranium tetrafluoride (UF_4) obtained from inventory and uranium hexafluoride (UF_6) from the gaseous diffusion plants. This paper discusses waste management and environmental restoration at FMPC. 11 figs., 5 tabs.

43947 (GAO/RCED–89-87) **Nuclear waste: Quarterly report as of December 31, 1988.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Feb 1989. 17p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the Nuclear Waste Policy Act that required the Department of Energy to implement a federal program for the safe and permanent disposal of high-level nuclear waste in one or more geologic repositories. It also assigned responsibility to the Nuclear Regulatory Commission to license and regulate these repositories. On December 28, 1988, DOE issued its final plan for characterizing (investigating) Yucca Mountain, Nevada. The first major characterization step is to construct an exploratory shaft facility, which will consist of two shafts mined to repository depth and underground testing rooms and will be used to conduct site characterization activities. Before DOE can begin constructing the exploratory shaft facility, it must develop, implement, and demonstrate to NRC that its quality assurance program for exploratory-shaft-related activities, including the design and construction of the facility, meets regulatory standards; obtain and consider NRC's comments on its site characterization plan; and hold public hearings in the vicinity of the site to inform area residents of the plan and receive their comments.

43948 (GAO/RCED–89-178) **Quarterly report as of March 31, 1989: Nuclear waste.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Aug 1989. 28p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that the Department of Energy plans to award a contract to manage and operate the federal government's nuclear waste repository. The proposed management and operating contract is likely to substantially affect program operations and costs. A major concern is the degree to which the selected contractor might replace, or possibly duplicate, the efforts now being carried out by DOE's current contractors. It is questionable whether the contract will result in a more efficient and effective program. DOE officials have had to divert their attention from program operations to develop the contract proposal and participate in legal proceedings related to a bid protest. GAO and the DOE inspector general have reported on problems and issues involving DOE's administration of

management and operating contracts, including some companies which participate in the nuclear waste program. Implementation of these recommendations could help ensure that the nuclear waste program is operated in a more cost-effective manner.

43949 (GAO/RCED–90-20) **Nuclear waste: DOE's budgeting process for grants to Nevada needs revision.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 19p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

The Department of Energy is awarding grants to the state of Nevada for the state's participation in DOE's program to investigate Yucca Mountain as a possible site for the disposal of civilian nuclear waste. This report has found that DOE's financial assistance budget request of $15 million for Nevada's fiscal year 1990 was not based on the amount the state requested but rather was derived by increasing Nevada's grant funds from the previous year in proportion to the increase that DOE requested for its own activities at the Nevada site. DOE's evaluations of Nevada's requests are performed too late to be used in DOE's budget formulation process because Nevada has been applying for financial assistance at about the same time that DOE submits its budget request to Congress.

43950 (GAO/RCED–90-103) **Nuclear waste quarterly report as of September 30, 1989.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Mar 1990. 34p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that at the end of the July-September 1989 quarter, DOE was not ready to begin site characterization, including construction of the exploratory shaft facility, at Yucca Mountain, Nevada. This was due to continuing delays in developing quality assurance programs, unresolved criticisms of the design of the exploratory shaft facility and DOE's proposed methods for constructing it, and a decision by the state of Nevada not to issue necessary environmental permits. In addition, the Nuclear Regulatory Commission and a group representing utilities had raised many significant concerns about DOE's approach to characterizing the site. In November 1989, DOE extended the repository's projected operating date by seven years, from 2003 to 2010. In doing so, it delayed by three years beginning construction of and testing in the exploratory shaft facility until November 1992 and September 1995, respectively. DOE also intends to evaluate early suitability of the site by conducting tests from the site's surface beginning in January 1991. DOE's new site characterization and approach are intended to result in a technically sound and cost-effective program.

43951 (GAO/RCED–90-109) **Nuclear waste transuranic waste storage limitations at Rocky Flats plant.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Mar 1990. 46p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that the current shutdown of Rocky Flats' weapons component production facilities and the uncertain duration of the shutdown prevents predicting when the plant's 1,601-cubic-yard-limit on transuranic waste storage is likely to be reached. Once restarted, however, production could continue for as long as six to eight months, depending on how successful Rocky Flats is in identifying and removing some nonregulated wastes from the current inventory. Production beyond this point is questionable until Rocky Flats installs a supercompactor to reduce the volume of waste stored on-site or arrangements are made to store the transuranic waste off-site.

43952 (GSF–16/89) **Investigation for determining the retention properties of rock over the ASSE II mine for dissolved radionuclides.** Bode, W. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung; Hannover Univ. (Germany, F.R.). Fachbereich Erdwissenschaften. Nov 1989. 220p. (In German). (GSF-TL–28/89). Order Number DE90517426. Source: NTIS (US Sales Only), PC A10/MF A01.

For a model consideration of groundwater movement and the associated transport of dissolved substance in deep groundwater, the retention properties of the ASSE II mine for radionuclides dissolved in water were determined. A series of properties of rocks were examined and described for this purpose. Apart from the chemical, mineralogical and petrophysical characteristics of the rocks, the retention was determined by 3 different methods and stated in the form of distribution coefficients for specific elements. A comparison of the results of vibration and diffusion experiments gave good agreement, while the results in through column experiments only reached the same order of magnitude after an expensive determination with the aid of a place concentration distribution. The distribution coefficients for the elements carbon, selenium, strontium, technetium, iodine, caesium, lead, radium, actinium, proto-actinium, uranium, neptunium, plutonium, americium and curium are listed and collected for model rock packages. (orig./HP).

43953 (KURRI-TR–331) **Proceedings of the specialists' meeting on radioactive wastes management.** Higashi, Kunio (Kyoto Univ. (Japan). Faculty of Engineering); Shimoura, Kazukuni (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. May 1990. 89p. (In Japanese). (CONF-9001109–: Specialists' meeting on radioactive wastes management, Kumatori (Japan), 23-24 Jan 1990). Order Number DE90513871. Source: NTIS (US Sales Only), PC A05/MF A01.

This issue is the collection of the papers presented at the title meeting. The 7 of the presented papers are indexed individually. (J.P.N.).

43954 (KWU-R–917/86/013) **Long-term leaching of spent fuel in rock salt and quinary brine and the influence of iron on mobilization of elements. Final report.** Wuertz, R.; Ellinger, M. Siemens AG Unternehmensbereich KWU, Karlstein (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1986. 85p. (In German). Contract BMFT KWA 5124/A7. Order Number DE90517364. Source: NTIS (US Sales Only), PC A05/MF A01.

One-year leaching tests of spent fuel in rock salt and quinary brine were continued for another year using the samples already leached before. Leaching of spent fuel was also examined in the presence of the storage container over pack material GGG 40.3 mild steel. Leach rates of pure spent fuel in quinary brine were unchanged in the second year for all nuclides examines; in rock salt brine an increase was observed for some nuclides supposedly due to surface oxidation during interim storage of the samples. Leach rates of all nuclides decreased by a factor of 5 to 10 in the presence of iron samples. Solubility of radionuclides is very low in saturatd brines to be expected in an assumed accident at the storage side compared to dilute solutions. The results of the leaching experiments in the presence of iron strongly influence the source term model in direction of reducing the mobilisation of radionuclides. (orig.) With 11 refs., 23 tabs., 32 figs.

43955 (LA–11787-MS) **Manganese-oxide minerals in fractures of the Crater Flat Tuff in drill core USW G-4, Yucca Mountain, Nevada.** Carlos, B.A.; Bish, D.L.; Chipera, S.J. Los Alamos National Lab., NM (USA). Jul 1990. 61p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. Order Number DE90014840. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Crater Flat Tuff is almost entirely below the water table in drill hole USW G-4 at Yucca Mountain, Nevada. Manganese-oxide minerals from the Crater Flat Tuff in USW G-4 were studied using optical, scanning electron microscopic, electron microprobe, and x-ray powder diffraction methods to determine their distribution, mineralogy, and chemistry. Manganese-oxide minerals coat fractures in all three members of the Crater Flat Tuff (Prow Pass, Bullfrog, and Tram), but they are most abundant in fractures in the densely welded devitrified intervals of these members. The coatings are mostly of the cryptomelane/hollandite mineral group, but the chemistry of these coatings varies considerably. Some of the chemical variations, particularly the presence of calcium, sodium, and strontium, can be explained by admixture with todorokite, seen in some x-ray powder diffraction patterns. Other chemical variations, particularly between Ba and Pb, demonstrate that considerable substitution of Pb for Ba occurs in hollandite. Manganese-oxide coatings are common in the 10-m interval that produced 75% of the water pumped from USW G-4 in a flow survey in 1983. Their presence in water-producing zones suggests

that manganese oxides may exert a significant chemical effect on groundwater beneath Yucca Mountain. In particular, the ability of the manganese oxides found at Yucca Mountain to be easily reduced suggests that they may affect the redox conditions of the groundwater and may oxidize dissolved or suspended species. Although the Mn oxides at Yucca Mountain have low exchange capacities, these minerals may retard the migration of some radionuclides, particularly the actinides, through scavenging and coprecipitation. 23 refs., 21 figs., 2 tabs.

43956 (LA–11867-MS) **Comparison of the fork and PYTHON spent-fuel detectors.** Rinard, P.M. (Los Alamos National Lab., NM (USA)); Bignan, G.; Capsie, J.; Romeyer-Dherbey, J. Los Alamos National Lab., NM (USA). Jul 1990. 72p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90015705. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Instruments to measure radiation from spent-fuel assemblies have been developed in the United States and in France. They have different objectives (safeguards and criticality safety) that have led to different designs, but are nevertheless sufficiently similar to compare and correlate. Small capsules of ^{252}Cf and ^{137}Cs were placed in a fuel pin and moved through a 17 x 17 array of pins. By raising the source pin, axial profiles were measured to help determine the total responses of the instruments to complete assemblies. The measurements show the relative contributions to the detectors' responses of neutrons and gamma rays from different pin locations. Sums of these measurements simulate total responses and how the instruments are correlated. Neutron absorbing pins containing gadolinium were inserted into the assembly to measure the dampening of the neutron count rates. These results will be useful in understanding the responses of spent fuel and fresh mixed-oxide fuel stored underwater with poison rods. 10 refs., 53 figs., 14 tabs.

43957 (LA–11892-M) **Drum counter design and operation manual.** Miller, D.W.; Ensslin, N. Los Alamos National Lab., NM (USA). Jul 1990. 26p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90015670. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This manual describes the design features, performance, and operating characteristics of a new 55-gal-drum neutron coincidence counter. The counter has six shielded banks of ^{3}He tubes and a motor-driven door with built-in safety interlocks. The new design has a good detection efficiency of 15%, moderate die-away time, and an efficiency profile flat to within 5 to 10%. The detectability limit is low enough to allow waste segregation at the 100 n Ci/g limit, and the fast Amptek electronics allow counting at rates up to 1.3 million counts/s. 2 refs., 14 figs., 6 tabs.

43958 (LA-UR–90-2566) **Automated homogeneous oxalate precipitation of Pu(III).** Yarbro, S.L.; Schreiber, S.B.; Dunn, S.L.; Mills, C.W. Los Alamos National Lab., NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-900802–4: 200. American Chemical Society national meeting, Washington, DC (USA), 26-31 Aug 1990). Order Number DE90015059. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Homogeneous oxalate precipitation using diethyl oxalate was compared to precipitating Pu(III) oxalate with solid oxalic acid. The diethyl oxalate technique at 75°C is better because it gives 50% less plutonium in the filtrate with a reasonable filtering time. Also, the procedure for the homogeneous precipitation is easier to automate because the liquid diethyl oxalate is simpler to introduce into the precipitator than solid oxalic acid. It also provides flexibility because the hydrolysis rate and therefore the precipitation rate can be controlled by varying the temperature. 5 refs., 3 figs., 3 tabs.

43959 (LBL–26852) **Mass transfer and transport in salt repositories.** Pigford, T.H.; Chambre, P.L.; Lee, W.W.L. Lawrence Berkeley Lab., CA (USA). Feb 1989. 5p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-891008–7: International symposium on safety assessment of radioactive waste repositories, Paris (France), 9-12 Oct 1989). Order Number DE90014509. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Salt is a unique rock isolation of nuclear waste because it is "dry" and nearly impermeable. In this paper we summarize some mass-transfer and transport analyses of salt repositories. First we analyses brine migration. Heating by high-level waste can cause brine in grain boundaries to move due to pressure-gradients. We analyze brine migration treating salt as a thermoelastic solid and found that brine migration is transient and localized. We use previously developed techniques to estimate release rates from waste packages by diffusion. Interbeds exist in salt and may be conduits for radionuclide migration. We analyze steady-state migration due to brine flow in the interbed, as a function of the Peclet number. Then we analyze transient mass transfer, both into the interbed and directly to salt, due only to diffusion. Finally we compare mass transfer rates of a waste cylinder in granite facing a fracture and in salt facing an interbed. In all cases, numerical illustrations of the analytic solution are given. 10 refs., 4 figs., 3 tabs.

43960 (NVO–334-2) **Yucca Mountain Project technical status report (TSR), October 1989–March 1990.** USDOE Nevada Operations Office, Las Vegas, NV (USA). Yucca Mountain Project Office. [1990]. 126p. Sponsored by U.S. DOE Radioactive Waste Management. Order Number DE90015030. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This Yucca Mountain Project Technical Status Report (TSR) on site characterization is the second in a series of reports that will be issued at approximately six-month intervals during site characterization. In addition, progress made toward the initiation and conduct of new site characterization activities is included. For this report, information on the technical progress made by Yucca Mountain Project participating organizations has been compiled covering the period from October 1989, through March 31, 1990. The status report consists of three sections: an introductory section; a section on the status of site characterization, which includes preparatory activities, sites programs, repository design, seals system design, waste package design, and performance assessment; and a reference section, which provides a complete listing of all published documents cited in the text. 59 refs.

43961 (PB–90-240417/XAB) **Estimation of the relative permeability distribution in fractured granitic rocks by means of vertical flow measurements in the Siblingen borehole, Switzerland. Water Resources Investigation.** Paillet, F.L.; Hess, A.E.; Morin, R.H. Geological Survey, Denver, CO (USA). Water Resources Div. 1990. 35p. (USGS/WRI–90-4034). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The report describes a technique for estimating the in situ vertical distribution of fracture permeability that appears to have important applications in radioactive-waste-disposal research. The technique uses high-resolution, vertical-flow profiling during pumping or injection to characterize the vertical distribution of permeability along the borehole. In several previous studies the technique has provided information that qualitatively agree with results from other permeability measurements, including packer tests and cross-hole pumping. The Siblingen-borehole experiment provides an opportunity to evaluate the results of permeability profiling using a high-resolution flowmeter with the results of other permeability measurements. The vertical-flow profile given for the Siblingen borehole in the report is presented in a form suitable for comparison with the results of these other measurements after they have been made, or when the results of experiments already performed at the site of the Siblingen borehole have been interpreted and published.

43962 (PNL–7302) **Strategy for identifying natural analogs of the long-term performance of low-level waste disposal sites.** Chatters, J.C.; Waugh, W.J.; Foley, M.G.; Kincaid, C.T. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 34p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90014824. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy's Low-Level Waste (LLW) Management Program has asked Pacific Northwest Laboratory (PNL) to explore the feasibility of using natural analogs of anticipated waste site and conditions to help validate predictions of the performance of LLW disposal sites. Current regulations require LLW

facilities to control the spread of hazardous substances into the environment for at least the next 500 years. Natural analog studies can provide information about processes affecting waste containment that cannot be fully explored through laboratory experimentation and modeling because of the extended period of required performance. For LLW applications, natural analogs include geochemical systems, pedogenic (soil formation) indicators, proxy climate data, and ecological and archaeological settings that portray long-term changes in disposal site environments and the survivability of proposed waste containment materials and structures. Analog data consist of estimates of performance assessment (PA) model input parameters that define possible future environmental states of waste sites, validation parameters that can be predicted by PA models, and descriptive information that can build public confidence in waste disposal practices. This document describes PNL's overall stategy for identifying analogs for LLW disposal systems, reviews lessons learned from past analogs work, outlines the findings of the workshop, and presents examples of analog studies that workshop participants found to be applicable to LLW performance assessment. The lessons from the high-level waste analogs experience and workshop discussions will be used to develop detailed study plans during FY 1990. 39 refs.

43963 (PNL–7391) **A review of potential alternatives for air cleaning at the Hanford Waste Vitrification Plant.** Sehmel, G.A. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 69p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90014829. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Pacific Northwest Laboratory conducted this review in support of the Hanford Waste Vitrification Plant (HWVP) being designed by Fluor Daniel Inc. for the US Department of Energy (DOE). The literature on air cleaning systems is reviewed to identify potential air cleaning alternatives that might be included in the design of HWVP. An overview of advantages/disadvantages of the various air cleaning technologies follows. Information and references are presented for the following potential air cleaning alternatives: deep-bed glass-fiber filters (DBGF), high-efficiency particulate air filters (HEPA), remote modular filter systems, high-efficiency mist eliminators (HEME), electrostatic precipitators, and the sand filter. Selected information is summarized for systems in the United States, Belgium, Japan, and West Germany. This review addresses high-capacity air cleaning systems currently used in the nuclear industry and emphasizes recent developments. 10 refs., 9 figs., 3 tabs.

43964 (PNL–7421) **In situ vitrification of soil from the Savannah River Site.** Campbell, B.E.; Buelt, J.L. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 34p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90016557. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Contamination associated with seepage basins and other underground structures at US Department of Energy sites may be effectively remediated by application of in situ vitrification (ISV) technology. In situ vitrification converts contaminated soil and buried wastes into a glass and crystalline block, similar to obsidian commingled with crystalline phases. Two bench-scale tests performed at Pacific Northwest Laboratory (PNL) in September 1989 demonstrated the feasibility of applying ISV to seepage basin soils at the Savannah River Site (SRS) in South Carolina. The two tests were performed on soils spiked with heavy metal and organic contaminants as well as stable radioactive simulants. These soils contain extremely low concentrations of alkali fluxes such as sodium and potassium oxides, which are necessary charge carriers for the ISV process. Tests performed on the low flux-containing soil indicate the soil can be vitrified with special application of the ISV process. Tests showed the hazardous and radioactive simulants were successfully bound in the vitrified product and the organics were mostly destroyed. Additional larger scale testing and evaluation are recommended to further study the feasibility of treating contaminated SRS soil by the ISV process. 13 refs., 12 figs., 7 tabs.

43965 (PNL–7430) **Contaminated Materials Treatment Program annual report for FY 1989.** Ross, W.A.; Powell, J.A. (comps.). Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 60p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90014846. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Western New York Nuclear Services Center reprocessed nuclear fuel for five years until operations were terminated in 1972. Underground tanks at the site contain high-level waste (HLW) generated during the reprocessing operations. Based on original agreements, the state of New York has assumed responsibility for the wastes and the site. The Department of Energy (DOE) is assisting New York State, through the West Valley Demonstration Project (WVDP), in processing and solidifying the HLW. The site contractor for the WVDP is West Valley Nuclear Services Co., Inc. (WVNS). The Pacific Northwest Laboratory (PNL), through the West Valley Support Project, has been supporting WVNS and DOE in establishing vitrification and waste processing technology and capability at the West Valley Site. The specific objective of the West Valley Support Project during FY 1989 were to complete designs of remote equipment, assist in characterizing the WVNS feed, sampling, ceramic melter and off-gas systems, provide chemical analysis of the radioactive wastes and testing of future processes with actual radioactive wastes, provide testing and modeling studies of the reference WV waste product, and conduct special studies, such as evaluating corrosion of the waste tanks and supporting operation of the supernatant treatment system. 13 refs., 13 figs., 5 tabs.

43966 (PNL–7440) **Field study of gravel admix, vegetation, and soil water interactions: Protective barrier program status report, FY 1989.** Waugh, W.J.; Thiede, M.E.; Kemp, C.J.; Cadwell, L.L. Link, S.O. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 36p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90014876. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Pacific Northwest Laboratory (PNL) and Westinghouse Hanford Company (Westinghouse Hanford) are collaborating on a field study of the effects of gravel admixtures on plant growth and soil water storage in protective barriers. Protective barriers are engineered earthern covers designed to prevent water, plants, and animals from contacting buried waste and transporting contaminants to groundwater or the land surface. Some of the proposed designs include gravel admixtures or gravel mulches on the barrier surface to control soil loss by wind and runoff. The purpose of this study is to measure, in a field setting, the influence of surface gravel additions on soil water storage and plant cover. The study plots are located northwest of the Yakima Gate in the McGee Ranch old field. Here we report the status of work completed in FY 1989 on the creation of a data management system, a test of water application uniformity, field calibration of neutron moisture gages, and an analysis of the response of plants to various combinations of gravel admixtures and increased rainfall. 23 refs., 11 figs., 6 tabs.

43967 (PNL-SA–17391) **Evaluation of near-field thermal environmental conditions for a spent fuel repository in tuff.** Altenhofen, M.K.; Eslinger, P.W. Pacific Northwest Lab., Richland, WA (USA). Mar 1990. 8p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-900406–71: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990). Order Number DE90015287. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A repository heat transfer analysis is being performed by the Pacific Northwest Laboratory (PNL) for the US Department of Energy's Performance Assessment Scientific Support Program. The objective of this ongoing study is to evaluate near-field host rock and waste package surface temperatures for a spent fuel repository system located in a tuff geologic medium. A spent fuel logistics model of the waste management system was used to evaluate the thermal characteristics of spent fuel emplaced in the repository. A three-dimensional heat conduction model of the underground repository facility was used to evaluate near-field host rock temperatures throughout the 10,000-year isolation period. The spent-fuel thermal characteristics and near-field host rock temperatures were then used to estimate waste package surface temperature histories and distributions for the repository system. The resulting temporal and spacial distributions provide key input to repository source

term model evaluations of waste isolation performance. 15 refs., 7 figs., 1 tab.

43968 (PNL-SA–17602) **Demonstration of an infiltration evaluation methodology.** Smyth, J.D. (Pacific Northwest Lab., Richland, WA (USA)); Gee, G.W.; Kincaid, C.T.; Nichols, W.M.; Bresler, E. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900794–2: ASCE conference on environmental engineering, Washington, DC (USA), 9-11 Jul 1990). Order Number DE90016292. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An Infiltration Evaluation Methodology (IEM) was developed for the US Nuclear Regulatory Commission (NRC) by Pacific Northwest Laboratory (PNL) to provide a consistent, well formulated approach for evaluating drainage through engineered covers at low-level radioactive waste (LLW) sites. The methodology is designed to help evaluate the ability of proposed waste site covers to minimize drainage for LLW site license applications and for sites associated with the Uranium Mill Tailings Remedial Action (UMTRA) program. The objective of this methodology is to estimate the drainage through an engineered burial site cover system. The drainage estimate can be used as an input to a broader performance assessment methodology currently under development by the NRC. The methodology is designed to simulate, at the field scale, significant factors and hydrologic conditions which determine or influence estimates of infiltration, long-term moisture content profiles, and drainage from engineered covers and barriers. The IEM developed under this study acknowledges the uncertainty inherent in soil properties and quantifies the influence of such uncertainty on the estimates of drainage in engineered cover systems at waste disposal sites. 6 refs., 1 fig.

43969 (PNL-SA–17771) **Acceptance of spent fuel of varying characteristics.** Short, S.M. Pacific Northwest Lab., Washington, DC (USA). Mar 1990. 8p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-900406–74: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990). Order Number DE90016355. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper is a preliminary overview of a study with the primary objective of establishing a set of acceptance selection criteria and corresponding spent fuel characteristics to be incorporated as a component of requirements for the Federal Waste Management System (FWMS). A number of alternative acceptance allocations and selection rules were analyzed to determine the operational sensitivity of each element of the FWMS to the resultant spent fuel characteristics. Preliminary recommendations of the study include three different sets of selection rules to be included in the FWMS design basis. 2 refs., 4 figs., 4 tabs.

43970 (PTB-SE–25) **Product control of radioactive waste. Proceedings.** Warnecke, E.; Giller, H. (eds.). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. 362p. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The aim of the seminar was to give a survey of product quality control and to find out whether the producers/conditioners of waste set and fulfil requirements for the quality of the waste. The program included the following main areas: Random sample tests; Container tests; Process qualification and inspection, and Inspections of waste from fuel element reprocessing abroad. In other lectures, there are reports on measures for producers of waste for guaranteeing the final storage requirements, on quality assurance measurements in the conditioning of waste from large research establishments and from fuel element manufacture. The calling up of waste containers and the documentation of waste data is also introduced. (orig./HP).

43971 (PTB-SE–25, pp. 1-10) **Survey of product quality control of radioactive waste.** Warnecke, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The PTB has developed basic procedures with regard to deriving final storage conditions and product quality control. After this, requirements for radioactive waste are derived via safety analysers, in which information about the radioactive waste, the geological overall situation of the site and the layout of the final storage mine, in particular, are included as basic data. The final storage conditions are only determined with the awarding of the planning decision. Compliance with them can be proved by random sample tests on waste containers or via a qualification and inspection of the conditioning process. (DG).

43972 (PTB-SE–25, pp. 11-31) **Requirements for waste barrels, waste products and waste containers.** Wurtinger, W. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The safety requirements for waste barrels, waste products and containers contained in the final storage conditions were derived from the safety analysis for the specific site. The results of the fault case analysis were decisive for structuring these requirements. Based on the basic requirements, which are made of all waste barrels regardless of the activity inventory, the safety requirements rise with an increasing activity inventory of a waste barrel. These rising requirements are, however, structured so that the producer of the waste can choose between different combinations and can therefore look for the most suitable one for this waste. (orig.).

43973 (PTB-SE–25, pp. 32-52) **Extent of tests of requirements for waste barrels.** Gruendler, D. (Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

For the requirements of the activity inventory, it is sufficient to test only a few key parameters, eg: for nuclear powerstation waste the Co60 and Cs137 activity and the water content. The extent of tests is also reduced for the requirements for the waste product, as the requirements specific to the waste product groups partly cover basic requirements and by taking into account suitable waste treatment processes, compliance with the requirements is ensured and the corresponding tests can be omitted. Compliance with the requirements for the packing is largely ensured by type qualification. Only visual inspections remain as tests in the context of product control. (orig./DG).

43974 (PTB-SE–25, pp. 53-64) **Requirements for reliability and accuracy in compliance with the final storage conditions.** Martens, B.R. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

It is shown what effects faulty barrel can have and what requirements for reliability in excluding faulty barrel from final storage can be derived from this. It is also explained how inaccuracies of determined results are dealt with in the context of product control. (orig./DG).

43975 (PTB-SE–25, pp. 65-74) **Survey of the random sampling system.** Merkel, A. (Siemens AG Unternehmensbereich KWU, Offenbach am Main (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The quantification of the extent of random sampling and its stages are justified technically and a mathematical statistical evaluation model of the test results is prepared. One tries to compile the test batches so that the barrels largely agree in their properties relevant to final storage. Waste barrels combined into test batches with a small degree of agreement or those which nearly reach the limits of the final store are tested more frequently. The extent of random sampling is derived from the sizes of batches. (DG).

43976 (PTB-SE–25, pp. 75-80) **Random sample process for securing mean fault proportions.** Deixler, A. (Siemens AG, Muenchen (Germany, F.R.). Zentralabteilung Produktion und Logistik). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The acceptance characteristic can be determined for each random sample instruction from the individual integral values for given fault proportions. These acceptance characteristics can be used to explain the statistical conclusions from a found number of random sample faults to the possible fault proportion in the associated batch. This is shown with the example of a random sample of extent 100 and a found number of faults 1 with the probability of acceptance of 5%. (DG).

43977 (PTB-SE–25, pp. 81-92) **Parameters, test criteria and fault assessment in random sampling of waste barrels from non-qualified processes.** Martens, B.R. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

In the context of random sampling tests, parameters are checked on the waste barrels and criteria are given on which these tests are based. Also, it is shown how faulty data on the properties of the waste or faulty waste barrels should be treated. To decide the extent of testing, the properties of the waste relevant to final storage are determined based on the conditioning process used. (DG).

43978 (PTB-SE–25, pp. 93-109) **Test and measurement devices of the product control department.** Odoj, R. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The execution of product quality control occurs from the points of view of irradiation loading of the test personnel, radiological relevance of the waste and ability of the control measures used to give information and their cost. A suitable and static control and test system justifable from the radiation protection aspect is described. It guarantees that only waste barrels which satisfy the final storage conditions are stored in Konrad. (DG).

43979 (PTB-SE–25, pp. 110-125) **Carrying out random sample tests.** Filss, P. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The required product properties and activity limitations can be checked by random sampling of representatively selected waste casks. The expense and the possibilities of testing with non-destructive tests are less than those of destructive tests. The most important non-destructive test process is cask measurement on the gamma scanner and the most important destructive test is sample drilling in the cask matrix. In determining the specific activity of Co-60, both processes lead to the same results. To minimise the amount of work and the radiological exposure of the test personnel, non-destructive tests should be carried out for the direct determination of the main nuclides. For waste from continuously operating processes, the nuclide which cannot be measured by non-destructive tests can be derived by calculation. (orig.).

43980 (PTB-SE–25, pp. 126-132) **Results of investigations on radioactive waste from nuclear power stations in Lower Saxony.** Kopp, D. (Umweltministerium des Landes Niedersachsen, Hannover (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

Altogether, 25 casks from the Stade nuclear power station and 49 casks from the Unterweser nuclear power station were examined. All the Stade casks and 10 Unterweser casks contained waste from the Belgian research reactor BR-3. There was no objection to the intermediate storage of the waste conditioned at Mol, either for reasons of radiation protection or from the technical point of view. The radioactivity limits of the existing authorisation for the Lower Saxony intermediate store are in no case exceeded. The quantity of Pu was between 10^{-9} and 10^{-8} g per gram of waste. The waste casks with the BR-3 waste showed no presence of gas. (DG).

43981 (PTB-SE–25, pp. 167-180) **Calling up waste casks and documentation of waste data.** Giller, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

Waste containers are reported for final storage by the organisation obliged to deliver them and are called up by the final store at certain dates with the aid of an EDP aided call-up system. The call-up starts with the preliminary reporting or the reporting of the waste container and ends with the delivery of the waste container to the final store. The call-up period is estimated at about a year for containers which must be subjected to random inspections. For containers which have already been tested in the context of product inspection, the call-up period is about 8 weeks. The course of the call-up process and documentation of the waste data are described. (orig./DG).

43982 (PTB-SE–25, pp. 181-191) **Characteristics and test criteria of qualified processes.** Martens, B.R. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany,

F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

In qualified processes, process-related characteristics or process parameters can occur (e.g.: the ability of the fixing material used to flow), by the inspection of which compliance with certain requirements of the final store is ensured and which are individually determined for the type of waste and conditioning plant concerned in the qualification of a conditioning process. There is an explanation of which properties and characteristics are to be determined or to be inspected in qualified processes, and how one judges, by test criteria, whether the requirements of the final store are being complied with. (orig.).

43983 (PTB-SE–25, pp. 192-234) **Qualification of conditioning process. Operation and inspection of qualified plant/process.** Wolf, J. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

A conditioning process is qualified by the PTB if the execution of pre-treatment and conditioning occurs so that a safe and orderly final storage of the products and waste containers produced can be assumed. All the relevant operating conditions for the plant are laid down by the producer/conditioner of the waste in a handbook. The elements of product inspection by process qualification are shown in tabular form. (DG).

43984 (PTB-SE–25, pp. 235-246) **Requirements for the product inspection of radioactive waste from the reprocessing of German fuel elements abroad.** Warnecke, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)); Martens, B.R. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The properties of radioactive waste are described by the reprocessing companies in specifications which are submitted to the customer with the aim of approval by the appropriate national authorities. In consequence, the specifications for radioactive waste are not only the subject of negotiations between the partners to the contract. They are discussed in the context of the German-French Commission (DFK) and between RSK and the French Groupe Permanent des Dechets Radioactifs (GPD). Discussions have been started with the appropriate British authorities on the specifications for BNFL waste. Only the Cogema and BNFL specifications for vitrified radioactive waste are available so far. (orig./DG).

43985 (PTB-SE–25, pp. 247-260) **Inspection of waste from fuel element reprocessing abroad. Carrying out the product inspection measures.** Montserrat, W. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen mbH (DWK), Hannover (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

To keep within the limits in the active vitrification process regarding the method of operation of the vitrification plant and the glass composition, quality inspections are necessary for the incoming material (fritted glass, container) and so is a suitable process instrumentation. Administrative, organisational and technical measures for quality assurance at COGEMA and their checking by independent experts are described. (DG).

43986 (PTB-SE–25, pp. 261-280) **Quality assurance in conditioning nuclear power station waste.** Rittscher, D. (Gesellschaft fuer Nuklearservice, Essen (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The GNS (Society for Nuclear Service, Essen) has mobile and fixed plants for conditioning radioactive waste from the operation of nuclear powerstations. The activities of the GNS in the context of disposal of such waste are listed. The quality assurance measures in the conditioning are carried out under their own independent supervision and under external supervision. The guidelines for the execution of product inspection and supervision are the BMU Guidelines which came into force in 1988. (DG).

43987 (PTB-SE–25, pp. 281-303) **The waste flow monitoring and product inspection system (AKV).** Podewils, P. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen mbH (DWK), Hannover (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The waste flow monitoring and product inspection system (AVK) provides all the relevant data so that they can be called up and makes it possible for the authorities to carry out the necessary inspections. The decoupling of the responsibility of all those participating in waste disposal according to the unravelling concept is reflected in the AVK. As a consequence of this decoupling; the data collection system in the AVK is built up modularly. The modules are produced according to the stations in the flow of waste and the tasks of the AVK. (DG).

43988 (PTB-SE–25, pp. 304-320) **Quality assurance measures for the conditioning of waste from fuel element manufacture.** Schneider, V.W. (Siemens Brennelementewerk, Hanau (Germany, F.R.)); Ledebrink, F.W. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

It is intended to show that a timely start was made in building up a quality assurance system which will enable one to conclude the process qualification soon. Using the documentation systems, information can be given on each cask conditioned in the past. An additional necessity for determining the fission product contents in the waste as accurately as possible is due to the obligation of the operator of a fuel element factory to prove the whereabouts of the fission material to the international supervision authorities. (orig.).

43989 (PTB-SE–25, pp. 321-345) **Quality assurance measures in the conditioning of waste at the Karlsruhe Nuclear Research Center.** Stegmaier, W. (Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.)). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

Ensuring the points for the release of the materials and compliance of the quality of waste containers (waste containers with waste products) according to section 9 of AtG is in the first place the task of the conditioning firms of the HDB. Regarding the release of residues and waste, the Main Safety Department (HS) is involved, which carries out and records the measurements necessary for release by the person at HDB responsible for radiation protection. The independent Quality Assurance Department of KfK

GmbH (HBT/QS) is active in compliance with the required quality of the waste containers and Department III of HDB independent of the conditioning firms is active in compliance of the quality of waste products. This gives effective self-monitoring inside KfK GmbH. (orig./DG).

43990 (PTB-SE–25, pp. 346-353) **Quality assurance measures in conditioning waste at the KFA Juelich.** Laser, M. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Abt. Dekontamination). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212–: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

In conditioning waste, processes are preferably used which ensure the fulfilment of important basic requirements, above all combustion and high pressure compression. All waste is accounted for. During conditioning a 'new measurement' is carried out at a suitable place and documentation corresponding to the final storage conditions is produced. (orig.).

43991 (RFP–4414) **Microwave vitrification of Rocky Flats TRU sludge.** Petersen, R.D. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-901075–1: Spectrum '90, Knoxville, TN (USA), 3-5 Oct 1990). Order Number DE90010808. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The aqueous wastes from the plutonium recovery areas at the Rocky Flats Plant (RFP) are treated in a hydroxide precipitation process to remove heavy metallic elements. The wet sludge alone does not meet the Waste Isolation Pilot Plant — Waste Acceptance Criteria (WIPP-WAC) prohibiting the presence of free liquids. In the present operation a Portland cement/diatomite mixture is added to the waste container to absorb free liquids. The TRU waste forms presently produced at RFP, with the absorbants, meet the criteria established by the WIPP-WAC. Bench scale microwave vitrification tests and pilot scale tests using TRU radioactive waste has begun.

43992 (SAND–88-1221) **Thermal and mechanical codes first benchmark exercise: Part 1, Thermal analysis: Yucca Mountain Project.** Costin, L.S.; Bauer, S.J. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 114p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE90014853. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

Thermal and mechanical models for intact and jointed rock mass behavior are being developed, verified, and validated at Sandia National Laboratories for the Yucca Mountain Project. Benchmarking is an essential part of this effort and is the primary tool used to demonstrate verification of engineering software used to solve thermomechanical problems. This report presents the results of the first phase of the first thermomechanical benchmark exercise. In the first phase of this exercise, three finite element codes for nonlinear heat conduction and one coupled thermoelastic boundary element code were used to solve the thermal portion of the benchmark problem. The codes used by the participants in this study were DOT, COYOTE, SPECTROM-41, and HEFF. The problem solved by each code was a two-dimensional idealization of a series of drifts whose dimensions approximate those of the underground layout in the conceptual design of a prospective repository for high-level radioactive waste at Yucca Mountain. 20 refs., 50 figs., 3 tabs.

43993 (SAND–90-1071C) **Phasic pressure difference effects in two-phase flow for dissolved gas exsolution.** Webb, S.W. (Sandia National Labs., Albuquerque, NM (USA)); Chen, J.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009228–1: Tough user's workshop, Berkeley, CA (USA), 13-14 Sep 1990). Order Number DE90015208. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Two-phase flow in porous media exists at the Waste Isolation Pilot Plant (WIPP) in the salt surrounding the repository. Under undisturbed conditions, the salt is probably brine saturated. However, dissolved gases are expected to come out of solution as the brine pressure decreases due to mining activities. The pressure in the gas bubbles will be much greater than that in the brine due to surface tension effects. In order to evaluate the effects for the WIPP, a preliminary model for the phasic pressure difference between the gas coming out of solution (gas exsolution) and the liquid phase has been developed. 10 refs., 2 figs., 1 tab.

43994 (SKB-TR–89-36) **^{14}C-analyses of calcite coatings in open fractures from the Klipperaas study site, Southern Sweden.** Possnert, G. (Svedberg-laboratoriet, Uppsala (Sweden)); Tullborg, E.L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Nov 1989. 27p. Order Number DE90637313. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Carbonate samples from open fractures in crystalline rock from the Klipperaas study site have been analysed for their ^{14}C contents using accelerator mass spectrometry. This technique makes it possible to analyse very small carbonate samples (c. 1 mg C). The analyses show low but varying contents of ^{14}C. However, contamination by CO_2 have taken place affecting small samples more than others. Attempts have been made to quantify the contamination and thus evaluate the analyses of the fracture samples. The obtained low ^{14}C values can be due to: 1. An effective retention of ^{14}C by sorption/fractionation forcing ^{14}C onto the calcite surfaces in the near-surface zone which means that the ^{14}C contribution to the deeper levels is diminished or 2. the penetration depth of surface groundwater is very shallow. The former is suggested as more probable based on evaluations of the hydrochemical conditions and the fracture mineral studies. (10 figs., 3 tabs., 9 refs.) (authors).

43995 (SRD-R–503) **Radioactive waste disposal by UKAEA establishments during 1987 and associated environmental monitoring results.** Phillips, F. (UKAEA Dounreay Nuclear Power Development Establishment (UK)); Jackson, R.G.; Austin, J.; Stammers, K.; Stonell, G.P. UKAEA Safety and Reliability Directorate, Culcheth (UK). Jul 1989. 69p. Source: Available from UKAEA Culcheth (UK), price Pound 6.00.

This report gives details of the radioactive solid, liquid and gaseous wastes disposed of by the United Kingdom Atomic Energy Authority in 1987 and summarises the results of environmental surveys designed to monitor their impact. (author).

43996 (USGS-OFR–89-234) **Hydrogeologic inferences from drillers' logs and from gravity and resistivity surveys in the Amargosa Desert, southern Nevada.** Oatfield, W.J.; Czarnecki, J.B. Geological Survey, Denver, CO (USA). 1989. 29p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AI08-78ET44802. Order Number DE90015533. Source: NTIS, PC A03/MF A01; OSTI; INIS; USGS Books and Open-File Reports Section, Box 25425, Denver, CO 80225-0425; GPO Dep.

The Amargosa Desert of southern Nevada, in the Basin and Range province, is hydraulically downgradient from Yucca Mountain, the potential site of a repository for high-level nuclear waste. Ground-water flow paths and flow rates beneath the Amargosa Desert are controlled in part by the total saturated thickness and the hydraulic properties of basin-fill alluvial sediments. Drillers' logs of water wells completed in alluvium were analyzed to help characterize the hydrogeologic framework underlying the Amargosa Desert. Fractions of coarse-grained sediments, calculated from each of these logs, were contoured using a universal-kriging routine to interpolate values. Results from a previous electrical sounding survey also were contoured, including the estimated depth to Paleozoic basement rocks. The vertical electric sounding results were obtained from individual depth-to-resistivity profiles, from which the average resistivity of the total profile and the resistivity of the upper 75 meters were calculated. the distribution and variations in average resistivity of the total depth correlated reasonably well with the distribution of variations in regional gravity. 24 refs., 17 figs.

43997 (WHC-EP–0288) **Single-shell tank systems technical support program plan.** Klem, M.J. (Westinghouse Hanford Co., Richland, WA (USA)); Golberg, C.E.; Gibby, R.D.; Giese, K.A.; Ruck, F.A.; Sonnichsen, J.C.; Wanner, D.D.; Wing, N.R.; Woodworth, K.A.; Fletcher, J.F. Westinghouse Hanford Co., Richland,

WA (USA). Jun 1990. 346p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE90015373. Source: NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This Single-Shell Tank Systems Technical Support Program Plan (TSPP) provides documentation of the required technology, resources, equipment, program funding, and plans for closure of the six single-shell tank (SST) operable units (OU). The SST OUs comprise treatment, storage, and disposal units (wastes, tanks, and soil contaminated by leaks) and past practice units (ancillary units and soil contaminated by spills). A systems engineering approach is being used as a management tool to assist in reaching a final disposal decision for the SST OUs. The systems approach is a structured process to define and solve a problem. It is useful for large programs that involve multiple scientific and engineering disciplines and span long time periods. The systems approach ensures that development activities are conducted in an integrated, efficient, thorough, logical, defensible, auditable, and verifiable manner. It will allow the US Department of Energy to meet Hanford Federal Facility Agreement and Consent Order milestones and develop the technology required for the supplemental environmental impact statement for SST waste. 19 refs., 41 figs., 46 tabs.

43998 (WHC-EP-0352) **Single-shell tank waste retrieval study.** Krieg, S.A.; Jenkins, W.W.; Leist, K.J.; Squires, K.G.; Thompson, J.F. Westinghouse Hanford Co., Richland, WA (USA). Jun 1990. 267p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE90015397. Source: NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The single-shell tank waste retrieval study describes efforts in support of the Hanford Federal Facility Agreement and Consent Order milestone M-06-01: "Identify Waste Retrieval Technologies to be Tested in Scale-Model Tank, October 1990." Descriptions of the single-shell tanks and the wastes they contain are summarized in this study. The tanks contain hazardous chemical and nuclear wastes generated during plutonium production operations at the Hanford Site. Waste retrieval technologies related to pumping, sluicing, air transport, and mechanical mining are reviewed. Recommendations are presented for testing and developing equipment for pumping, sluicing, conveying, and mechanical mining of the waste in the single-shell tanks. Three types of positive displacement pumps, air jets, and water jets are recommended for testing. One air conveyance system and one mechanical conveyor system are also recommended for testing for transporting waste out of the single-shell tanks. Development of a mechanical arm and related mining and general use tools is recommended for breakup and removal of saltcake, riser pipes, and miscellaneous debris. The mechanical arm will also be used to position pumps or other equipment within the single-shell tank. 12 refs., 51 figs., 12 tabs.

43999 (WHC-EP-0356) **Waste analysis plan for single-shell tank compatibility.** Golberg, C.E. Westinghouse Hanford Co., Richland, WA (USA). Jun 1990. 26p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-87RL10930. Order Number DE90015476. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Waste Analysis Plan for Single-Shell Tank Compatibility describes the information and procedures required to evaluate the compatibility of pumpable mixed waste from the unstabilized single-shell tanks for interim storage in the double-shell tanks on the Hanford Site. The scope of work defined will determine the type of mixed waste, the transuranic resolubilization potential of selected noncomplexed waste, and the compatibility of the wastes during interim storage in the double-shell tanks. The liquid waste sampling, laboratory analysis, and compatibility evaluation are performed before pumping and interim stabilization of the tanks occur. These efforts are the initial steps of the interim stabilization and isolation process. The waste analysis plan is presented in the following main sections: introduction, facility description and waste description, identification of wastes to be managed, parameters to be monitored, waste sampling and analysis, references, and glossary. the appendices to these sections include a list of potentially incompatible wastes and a description of the quality assurance and quality control program. The waste analysis plan will be revised to ensure that changes in these areas remain current. 9 refs., 1 fig., 1 tab.

44000 (WHC-SA-0818) **Facility-specific waste minimization plans at Westinghouse Hanford Company.** Craig, P.A. Westinghouse Hanford Co., Richland, WA (USA). Jun 1990. 8p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-900631-2: International conference on pollution prevention: clean technologies and clean products-the environmental challenge of the 1990's, Washington, DC (USA), 10-13 Jun 1990). Order Number DE90015376. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A waste minimization program is required by public law and federal and state regulations for hazardous waste generators and treatment, storage, and disposal facilities. The US Department of Energy (DOE) has directed its contractors to develop an effective strategy to minimize the generation of hazardous, radioactive, and mixed wastes at the Hanford Site in compliance with state and federal regulations. Since Westinghouse Hanford Company (Westinghouse Hanford) has a large and diversified operation, a key component of the Westinghouse Hanford waste minimization program is facility-specific waste minimization plans which document present and future activities to reduce the volume and toxicity of waste generated. Preparation and implementation of these plans will demonstrate facility compliance to Westinghouse Hanford and DOE requirements, as well as state and federal regulations. The plans include both the goals and the activities for their achievement and provide a basis for evaluation. Preparation of the plans is divided into two phases. The first phase involves writing the "general" plan which describes the facility operations, the types of waste produced, and the administrative controls used by the facility to ensure waste minimization. The second phase involves a detailed characterization of each waste stream. This characterization includes baselining the quantity of waste generated, brainstorming possible options to minimize waste, and documenting other factors such as cost and environmental and safety issues involved with the generation of the waste. This section is ever-changing as more information is obtained and as the waste minimization program evolves. 2 figs.

44001 **Materials evaluation in a low-level radioactive waste incinerator.** Smolik, G.R. (Idaho National Engineering Lab., EG and G Idaho, Inc., Idaho Falls, ID (US)); Dalton, J.D. 15p. National Assoc. of Corrosion Engineers, Houston, TX (USA) (1989). (CONF-890437--: Corrosion '89, New Orleans, LA (USA), 17-21 Apr 1989). Technical Paper 89207.

This paper reports performances of alloys in a low-level radioactive, combustible waste incinerator evaluated. Test coupons and an extracted heat exchanger tube were examined to provide information on alloy behavior in the off-gas system of this facility. Type 316 stainless steel, the alloy of which the heat exchanger is constructed, was most extensively examined. Coupons exposed upstream of the heat exchanger exhibited high temperature corrosion rates of ~ 100 mpy (incinerator operation time). The rate observed from the heat exchanger tube was lower, ~ 25 mpy. Other alloys were tested to identify potential replacement candidates.

44002 **Nuclear waste repository siting: An alternative approach.** Soloman, B.D. (Energy Information Administration, U.S. Department of Energy, Washington, DC (US)); Cameron, D.M. pp. 119-126 of Hazardous materials disposal: Siting and management. Chatterji, M. Gower Publishing Co., Brookfield, VT (USA) (1987).

This paper discusses the geopolitics of nuclear waste disposal in the USA. Constitutional choice and social equity perspectives are used to argue for a more open and just repository siting program. The authors assert that every potential repository site inevitably contains geologic, environmental or other imperfections and that the political process is the correct one for determining sites selected.

44003 **Cementitious materials in nuclear waste management.** Roy, D.M. (Materials Research Lab., The Pennsylvania State Univ., University Park, PA (US)). pp. 261-292 of Cements research progress. 1988. American Ceramic Society Inc., Columbus, OH (USA) (1990). Grant DMR-8812854.

Cementitious materials have been investigated extensively to establish their role, and enable a prediction of their performance,

when used for radioactive waste isolation. A number of applications have been addressed, ranging from those in high-level waste management, where their prime roles would be physical such as in sealing an underground waste repository, mechanical to serve as a protective cask for transport, or under certain conditions, both chemical and physical in the solidification of high-level waste. Cements also have been explored for their use in forming primary casks for containment of spent fuel assemblies. For the disposal of low-level (and in some countries, intermediate-level) waste, a cementitious matrix may be used to encapsulate the waste, thereby generating an integral waste form. In addition, concretes will be required to perform special structural roles, used to construct trenches, vaults, and other disposal units. Also, there are numerous applications where grouts are used for sealing purposes. This paper addresses each of these areas.

0530 Environmental Aspects

Refer also to citation(s) 43932, 43934, 43947, 43952, 43955, 43960, 43966, 43967, 44002, 44439, 46200

44004 (LBL–27045) **A review of near-field mass transfer in geologic disposal systems.** Pigford, T.H. (California Univ., Berkeley, CA (USA). Dept. of Nuclear Engineering); Chambre, P.L.; Lee, W.W.L. Lawrence Berkeley Lab., CA (USA). Feb 1990. 96p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (UCB-NE–4145). Order Number DE90016618. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

In this report we summarize the analyses of the time-dependent mass transfer of radionuclides from a waste solid into surrounding porous or fractured media that have been developed at the University of California, Berkeley. For each analysis we describe the conceptual model, we present the governing equations and the resulting analytic solutions, and we illustrate the results. Designers of geologic disposal systems for solid waste must predict the long-term time-dependent rate of dissolution of toxic contaminants in ground water, to provide the source term for predicting the later transport of these contaminants to the environment. Mass-transfer analysis is being used to predict rates of dissolution and release of radioactive constituents in future repositories for high-level radioactive waste, and it has been applied to predict the life of a copper container for high-level radioactive waste. Mechanistic analysis of mass-transfer is based on well-established theory of diffusive-convective transport. Its application requires experimental measurement of well-defined parameters such as porosity, solubility, diffusion coefficient, and pore velocity. Our first analysis assumed a waste solid in direct contact with porous rock. Subsequently we analyzed the more realistic situations of backfill between the waste and rock, rock with discrete fractures as well as pores, and the effects of waste constituents of high solubility. Those dealing with specifically with mass transfer in the near field are presented here. In order to have a consistent set of notation within this review, some of the notation here is different than in the reports cited. 71 refs., 47 figs., 7 tabs.

0540 Health and Safety

Refer also to citation(s) 43932, 43945, 43946, 43962, 44002, 44340, 44433, 44437, 44441, 45324, 45583

44005 (DOE/S–0077P) **Environmental restoration and waste management: Five year plan, fiscal years 1992–1996: Executive summary.** USDOE, Washington, DC (USA). Jun 1990. 63p. Sponsored by U.S. DOE Office of the Secretary. Order Number DE90016002. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document reaffirms the US Department of Energy's (DOE's) commitment to a 30-year goal of compliance with laws, regulations, and agreements aimed at protecting human health and the environment; consolidates DOE's planning for Environmental Restoration, Waste Operations (including Corrective Activities), and Technology Development (including Transportation and Education); reports progress made toward achieving compliance goals; and explains changes in strategy due to new policies and external events. 16 figs.

44006 (FMPC–2204) **Multiple restoration projects management: Operable unit case study.** Gimpel, R.F. Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center. 2 Jul 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-86OR21600. (CONF-9009233–1: ENSOL '90, Santa Clara, CA (USA), 12 Sep 1990). Order Number DE90016227. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Feed Materials Production Center (FMPC), located near Cincinnati, Ohio, is a government-owned facility. Westinghouse Materials Company of Ohio (WMCO) is the prime contractor to the United States Department of Energy (DOE) at the FMPC. DOE has entered into a Consent Agreement with the United States Environmental Protection Agency (US EPA) to remediate the FMPC site. A project known as the Environmental Remedial Action (ERA) Project was created to accomplish the task of remediating the site. The majority of the estimated $2-billion ERA Project was broken into five smaller manageable subtasks called "operable units." Each operable unit is handled as a project with its own project manager/engineer. Due to the project's complexity and stringent completion dates, DOE and WMCO have devised a project management philosophy to ensure the successful completion of the ERA Project. This paper is the last of a three-paper series that discusses the ERA project management from different management level perspectives, which include: (1) ERA Project Manager level (top management), (2) Remedial and Removal Action level (middle management), and (3) Operable Unit level (lower management). This paper will describe in greater detail the make-up and management of an operable unit, specifically Operable Unit 1, which deals with the remediation of the Waste Storage Area. Some topics that will be discussed in this paper are: remedial investigation and feasibility study (RI/FS); project management matrix; design; development; schedules/scheduling; estimates, budget, and funding; construction contracts and interfaces; and DOE, RI/FS and design firms, EPA, and public interfaces. 2 refs., 4 figs., 7 tabs.

44007 (INIS-XN–248) **Nuclear Energy in Perspective.** Nuclear Energy Agency, 75 - Paris (France). 1989. 118p. Order Number DE90636797. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

This report provides the interested non-specialist reader with insights on five major issues associated with nuclear power generation: nuclear development and economics, protection of man and the environment, power plant safety, radioactive waste management and compensation for damage from a nuclear accident.

44008 (ORNL/TM–11564) **Integrating NEPA [National Environmental Policy Act] and CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] requirements during remedial responses at DOE facilities.** Levine, M.B.; Smith, E.D.; Sharples, F.E.; Eddlemon, G.K. Oak Ridge National Lab., TN (USA). Jul 1990. 60p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90014775. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

US Department of Energy (DOE) Order 5400.4, issued October 6, 1989, calls for integrating the requirements of the National Environmental Policy Act (NEPA) with those of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for DOE remedial actions under CERCLA. CERCLA requires that decisions on site remediation be made through a formal process called a Remedial Investigation/Feasibility Study (RI/FS). According to the DOE order, integration is to be accomplished by conducting the NEPA and CERCLA environmental planning and review procedures concurrently. The primary instrument for integrating the processes is to be the RI/FS process, which will be supplemented as needed to meet the procedural and documentational requirements of NEPA. The final product of the integrated process will be a single, integrated set of documents; namely, an RI report and an FS-EIS that satisfy the requirements of both NEPA and CERCLA. The contents of the report include (1) an overview and comparison of the requirements of the two processes; (2) descriptions of the major tasks included in the integrated RI/FS-EIS process; (3) recommended contents for integrated RI/FS-EIS documents; and (4)a discussion of some potential problems in integrating NEPA and CERCLA that fall outisde

the scope of the RI/FS-EIS process, with suggestions for resolving some of these problems. 15 refs.

44009 (PNL–7417) **Hanford radiological protection support services annual report for 1989.** Lyon, M.; Bihl, D.E.; Fix, J.J.; Kenoyer, J.L.; Leonowich, J.A.; Palmer, H.E. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 88p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90016199. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Certain sitewide radiation protection services operated by Pacific Northwest Laboratory for the US Department of Energy-Richland Operations office and Hanford contractor are documented in this annual report on these services provided during calendar year 1989. These activities include internal dosimetry, in vivo measurements, external dosimetry, instrument calibration and evaluation, radiation source calibration, and radiological records keeping. In each case the routine program, program changes, associated tasks, investigations, and studies, as well as related publications, presentations, and other professional activities are discussed as applicable. 26 refs., 19 figs., 18 tabs.

44010 (PNL-SA–18092) **Summary of the CEC/USDOE workshop on uncertainty analysis.** Elderkin, C.E. (Pacific Northwest Lab., Richland, WA (USA)); Kelly, G.N. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 22p. Sponsored by Commission of the European Communities; U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9005113–1: Seminar on methods and codes for assessing the offsite consequences of nuclear accidents, Athens (Greece), 7-11 May 1990). Order Number DE90015549. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

There is uncertainty in all aspects of assessing the consequences of accidental releases of radioactive material, from understanding and describing the environmental and biological transfer processes to modeling emergency response. The need for an exchange of views and a comparison of approaches between the diverse disciplines led to the organization of a CEC/USDOE Workshop on Uncertainty Analysis held in Santa Fe, New Mexico, in November 1989. The workshop brought together specialists in a number of disciplines, including those expert in the mathematics and statistics of uncertainty analysis, in expert judgment elicitation and evaluation, and in all aspects of assessing the radiological and environmental consequences of accidental releases of radioactive material. In addition, there was participation from users of the output of accident consequences assessment in decision making and/or regulatory frameworks. The main conclusions that emerged from the workshop are summarized in this paper. These are discussed in the context of three different types of accident consequence assessment: probabilistic assessments of accident consequences undertaken as inputs to risk analyses of nuclear installations, assessments of accident consequences in real time to provide inputs to decisions on the introduction of countermeasures, and the reconstruction of doses and risks resulting form past releases of radioactive material.

44011 (UCRL–102115) **Preclosure safety analysis for a prospective Yucca Mountain conceptual design repository.** Ma, C.W. (Bechtel National, Inc., San Francisco, CA (USA)); Jardine, L.J. Lawrence Livermore National Lab., CA (USA). Dec 1989. 11p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-900406–72: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990). Order Number DE90015613. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A preliminary probabilistic risk assessment was performed for the prospective Yucca Mountain conceptual design repository. A new methodology to quantify radioactive source terms was developed and applied in the analysis. The study identified 42 event trees comprising 278 accident scenarios. The maximum offsite dose evaluated in this study is about 1000 mrem. For the majority of the accident scenarios, either the offsite dose is less than 100 mrem or the probability of occurrence is less than 1×10^{-9}/yr. Only 11 accident scenarios with a dose larger than 100 mrem and an associated probability greater than 1×10^{-9}/yr were identified. A more detailed follow-on analysis for seismic events of various severity was also performed, and similar results were obtained. Therefore, based on the results of this analysis, no significant risk to the general public was identified during the preclosure period for the conceptual repository design. 13 refs., 4 figs., 2 tabs.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 43918, 43956, 43957, 44433, 44434

44012 (ETDE-IT–90-35) **An application of tracer techniques: Determination of the mass of uranium in the input solution of reprocessed Elk River fuel.** Trincherini, P.R.; Guzzi, G.; Altamura, V.; Miglietta, S. Commission of the European Communities, Ispra (Italy). Joint Research Centre; ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile. Jul 1989. 3p. (CONF-8905341–1: 11. annual symposium on safeguard and nuclear material management, Luxembourg (Luxembourg), 30 May 1989). Order Number DE90514511. Source: NTIS (US Sales Only), PC A02.

Paper presented at the 11th annual symposium on safeguard and nuclear material management (Luxembourg, 30 May-1 Jun 1989).

An experiment was performed to test the application of lutetium as a tracer in the direct determination of the mass of uranium contained in an accountability tank of the ITREC reprocessing plant at Rotondella (Italy). The whole experiment was the result of a collaboration between the Joint Research Centre of Ispra (Italy) and ENEA (Italian Commission for Alternative Energy Sources). The comparison between conventional and tracer methods was evaluated. The results obtained with the tracer technique are in good agreement (0.54%) with the plant data. A detailed technical description of the experiment and a complete set of results are presented.

44013 (LA–11864-MS) **An HEU [highly enriched uranium] confirmatory measurement instrument.** Sprinkle, J.K. Jr. (Los Alamos National Lab., NM (USA)); Brumfield, T.L.; Johnson, L. Los Alamos National Lab., NM (USA). Jul 1990. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90015479. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Precise measurements of an attribute of the special nuclear material (SNM) in a shipping container can confirm that the SNM was not tampered with during shipping. These measurements do not require a calibration, but they should be based on an attribute unique to each sample. This report describes a new instrument, based on a vertical stack of low-resolution detectors, designed to record such a unique attribute: gamma-rays at 185.7 keV, 1001 keV, and 2614 keV. It collects data for 200 s from sealed shipping containers (208-L barrels). These measurements distinguish the issue of material control (has any material been diverted?) from the issue of measurement control (is there a bias between the shipper's and the receiver's measurements of the same item?). This is an important distinction because material control problems require prompt corrective measures, while measurement control problems are never solved (they just get smaller). This instrument satisfies the regulatory requirements for material control in shipper-receiver transfers. In-plant measurement data are presented to illustrate the stability of the instrument and its ability to distinguish between similar items. 10 refs., 11 figs., 1 tab.

44014 (LA-UR–90-2209) **Robot speeds assays and enhances safeguards.** Phelan, P.F.; Powell, W.D.; Blankenship, R.W. Los Alamos National Lab., NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9007106–50: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015105. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At the Los Alamos National Laboratory Plutonium Facility, a robotics system utilizing a gantry robot and an automated inventory system operates five calorimeters and two gamma isotopic assay instruments. This system has significantly improved safeguards, because the opportunity for diversion has been greatly reduced. Not only is the accountability much more timely because throughput has doubled but the special nuclear material has been made physically more secure in several ways. First, items awaiting assay are kept in the inventory system, whose doors remain locked

whenever the robot is unattended. An alarm sounds if the doors are unlocked without authorization. Second, light curtains surround the robot's work envelope and pressure-sensitive pads cover the floor to detect entry into the assay area. Third, the robot weighs each item whenever it is moved, and the result is compared with the weight that was measured when the item was first put into inventory. 2 refs., 3 figs.

44015 (LA-UR–90-2312) **Holdup counters for the Plutonium Fuel Production Facility–PFPF.** Miller, M.C. (Los Alamos National Lab., NM (USA)); Menlove, H.O.; Seya, M.; Takahashi, S.; Adedin-Zadeh, R. Los Alamos National Lab., NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9007106–46: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015029. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A neutron coincidence counting system has been developed for assaying plutonium holdup in glove boxes at the automated mixed-oxide fuel fabrication facility, PFPF, in Japan. The time-correlated neutron emission rate arising from the spontaneous fission decay of plutonium isotopes is measured and converted to grams of plutonium contained in the glove box. Each detection system consists of a pair of polyethylene slabs containing ^{3}He proportional counters and associated electronics. These slabs are placed on either side of the glove box that is to be measured for plutonium holdup. The detectors are moved by a portable lifter to map out the coincidence response from the entire glove box. Results of a design optimization study that considered detector efficiency, as well as overall size and weight and how these parameters interface with the procedure of mapping the glove box, are presented. The use of Los Alamos transport code, MCNP, in the detector design optimization and in aid of calibration is also discussed. 2 refs., 8 figs., 1 tab.

44016 (LA-UR–90-2378) **Systems work for Plutonium Fuel Production Facility (PFPF) near-real-time accounting.** Picard, R.R. (Los Alamos National Lab., NM (USA)); Hafer, J.F.; Pillay, K.K.S.; Takahashi, S.; Ohtani, T.; Eguchi, K.; Seya, M. Los Alamos National Lab., NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9007106–40: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90014914. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A joint effort by the Los Alamos National Laboratory and the Power Reactor and Nuclear Fuel Development Corporation of Japan examines materials accounting for the Plutonium Fuel Production Facility. A unique feature of the systems work is a sophisticated data generator. This software follows individual items throughout the process, creating detailed data files for variance propagation. The data generator deals with user-specified process operations and handles related accounting problems, such as the tracking of individual measurements through numerous blending and splitting procedure, frequent decay correction (important for large inventories), scrap recovery, and automated determination of static inventory. There is no need to rely on simplified assumptions regarding process operation and material measurement. Also, the joint study applies recent theoretical work on stratified inspection of nonhomogeneous inventories and sequential analysis of MUF – D. 4 refs.

44017 (SAND–90-1660C) **The Mobile Intrusion Detection and Assessment System (MIDAS).** Arlowe, H.D.; Coleman, D.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9007106–2: Institute of nuclear materials management conference; Carnahan conference on security technology, Los Angeles, CA (USA); Lexington, KY (USA), 15-18 Jul 1990; 10 oct 1990; CONF-901092–2). Order Number DE90012760. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes MIDAS, the Mobile Intrusion Detection and Assessment System. MIDAS is a security system that can be quickly deployed to provide wide area coverage for a mobile asset. MIDAS uses two passive infrared imaging sensors, one for intruder detection and one for assessment. Detected targets are tracked while assessment cameras are directed to view the intruder location for operator observation and assessment. The dual sensor design allows simultaneous detection, assessment, and tracking. Control and status information is provided to an operator using a color graphics terminal, touch panel driven menus, and a joystick for control of the assessment sensor pan and tilt. 1 ref., 5 figs.

44018 (UCRL–102705) **A transportable x-ray fluorescence analysis system for assay of plutonium and uranium solutions in gloveboxes.** Ruhter, W.D. (Lawrence Livermore National Lab., CA (USA)); Camp, D.C.; Schenkel, R.; Wagner, H.G.; Goerten, J.; Cromboom, O. Lawrence Livermore National Lab., CA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007106–55: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015206. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It is becoming increasingly more difficult and expensive for safeguards authorities to transport solution samples from inspected facilities to laboratories for analysis. We have developed a transportable x-ray fluorescence analysis (XRFA) instrument that can assay plutonium and uranium solutions in glove boxes without any modifications to the glove box. This instrument will reduce the need to transport plutonium solution samples for analysis, thus saving time and reducing costs in inspection efforts. The system utilizes a portable high-purity germanium detector, transportable pulse-processing electronics, and a portable IBM-compatible computer. The measurement head of our instrument is placed inside a glove-box glove. Inside the glove box a hollow cylinder is held in place by the measurement head with the glove partially surrounding it, then solutions contained in 15-mL polystyrene test tubes are inserted into the cylinder for assay by XRFA. The radioisotope ^{57}Co is used to excite the uranium and plutonium K-series x rays, and a combined ^{57}Co and ^{153}Gd source is used for transmission measurements to correct the observed x-ray intensity for sample self-attenuation effects. We have tested and evaluated the instrument at the European Institute for Transuranium Elements and demonstrated that 1% accuracies are achievable using eight uranium and seven plutonium reference solutions ranging in concentration from 50 to 411 g/L and 50 to 303 g/L, respectively. 3 refs., 2 figs., 2 tabs.

44019 Nuclear Waste Policy Act Amendments of 1988. Introduced in the Senate, One Hundredth Congress, Second Session, Report 100-517, September 16, 1988. Calendar No. 950. 8p. Government Printing Office, Washington, DC (US) (1988).

After consideration of bill S. 2800, a bill to amend the Nuclear Waste Policy Act of 1982 with respect to the Office of Nuclear Waste Negotiator and the Monitored Retrievable Storage (MRS) Commission, the Committee on Energy and Natural Resources reported favorably on the bill and recommended its passage. This bill would establish the Office of Nuclear Waste Negotiator as an independent establishment in the executive branch and would extend the deadline for submission of the MRS report from 1 June 1989 to 1 November 1989. The background and need for the bill, its legislative history, and the voting positions of Committee members regarding the bill are all included.

0560 Legislation and Regulations

Refer also to citation(s) 43934, 44000, 44002, 44019, 44255, 44257, 44434, 44436, 44443

44020 (INIS-mf–11595) **Regulations respecting the packaging and safety marking of radioactive materials preparatory to transport.** Canada. 29 Sep 1983. 55p. Order Number DE90615126. Source: NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Published in Canada Gazette Part II v. 117 (no. 19) SOR/83-740 P.C. 1983-2984.

These regulations establish Canadian requirements for packaging and safety marking of radioactive material preparatory to transport.

44021 (INIS-mf–11596) **Radiation emitting devices act: Revised statutes of Canada, chapter 34 (1st. supp.).** Canada.

1970. 10p. Order Number DE90615120. Source: NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Amended by 1984, c. 23.

This Act, entitled the Radiation Emitting Devices Act, is concerned with the sale and importation of radiation emitting devices. Laws relating to the sale, lease or import, labelling, advertising, packaging, safety standards and inspection of these devices are listed as well as penalties for any person who is convicted of breaking these laws.

44022 (INIS-mf–11599) **Bill C-5, an act to amend the radiation emitting devices act.** Canada. 26 Jun 1984. 11p. Order Number DE90615122. Source: NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

2. session, Thirty-second Parliament, 32-33 Elizabeth II, 1983-84.

This Act, entitled Bill C-5, allows for a series of amendments to the Radiation Emitting Devices Act. The amendments relate to regulations concerned with the sale, lease or import, labelling, advertising, packaging, safety standards and inspection of radiation emitting devices.

44023 S. 2258: Independent Spent Nuclear Fuel Storage Act of 1990. Introduced in the Senate of the United States, One Hundredth First Congress, Second Session, March 8, 1990. 6p. Government Printing Office, Washington, DC (US) (1990).

This bill was introduced into the United States Senate March 8, 1990. The purpose of the bill is to amend the Nuclear Waste Policy Act of 1982 to allow commercial nuclear utilities that have contracts with the Secretary of Energy under section 302 of that Act to receive credits to offset the cost of storing spent fuel that the Secretary is unable to accept for storage on and after January 31, 1998. The credits will be deducted from each remittance of a person's fee payments to the Nuclear Waste Fund and will be in the amount of 0.56 mil per kilowatt-hour for electricity generated by the person's civilian nuclear power reactor and sold during the period the person is eligible for the credit.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

44024 Heterodyne laser spectroscopy system. Wyeth, R.W.; Paisner, J.A.; Story, T. To Dept. of Energy, Washington, DC (USA). USA Patent 4,905,244/A/. 27 Feb 1990. Filed date 15 Jun 1988. USA Patent Application 7-207,996. Int. Cl. H01S 3/13. 20p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a heterodyne laser spectroscopy system utilizing laser heterodyne techniques for purposes of laser isotope separation spectroscopy, vapor diagnostics, processing of precise laser frequency offsets from a reference frequency, and provides spectral analysis of a laser beam.

44025 Gas separation with rotating plasma-arc reactor. Hollis, D.; McLendon, J.; Broderick, D. To Department of the Interior, Washington, DC. USA Patent Application 7-477,395. 9 Feb 1990. 25p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The invention pertains to the use of rotating plasma arc reactors to effect a one stage separation or enrichment of a gas component from a composite gas at a plasma rotational or angular speed of at least 60,000 rpm.

0702 Radiation Sources

Refer also to citation(s) 44306, 45556

44026 (ENEA-RT-TIB–89-31) **Ionic molecular films. Applications. 3. Electron beam stimulated enhanced adherence.** Baldacchini, G.; Montereali, R.M.; Scavarda do Carmo, L.C. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Nov 1989. 9p. (RT/TIB–89-31). Order Number DE90514482. Source: NTIS (US Sales Only), PC A02/MF A01.

This paper reports on the advantages of the use of the technique of electron beam lithography to imprint enhanced sensitive patterns on ionic molecular substrates (bulk crystals or films). With this technique, localized superficial defects are produced which change the chemical properties of surfaces. Sensitized surfaces react with absorbates providing enhanced adherence of such substances. The use of spacially controlled electron beams allows the construction of small (sub-micron) feature chemical and very localized enhanced adherence of absorbates.

44027 (ETDE-IT–90-50) **Radiation treatment of hazardous wastes: A preliminary survey.** Liuzzo, G.; Tata, A. Rome Univ. (Italy); ENEA, Casaccia (Italy). Centro Ricerche Energia. Oct 1988. 16p. (CONF-881020–2: 4. international symposium on radiation physics (ISRP-4), Sao Paulo (Brazil), 3-7 Oct 1988). Order Number DE90514525. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 4th international symposium on radiation physics (Sao Paulo, 3-7 Oct 1988).

Environmental pollution from industrial hazardous wastes is becoming in industrially advanced countries a very serious problem due to both the lack of adequate treatment/disposal systems or plants for a large part of produced wastes and the increasing severity of national laws on the matter. In Italy, for example, toxic and hazardous wastes production reaches about four million tons per year, of which only one fourth is being adequatelly treated. Low effectiveness and/or high unit costs of many traditional treatment methods have opened large spaces to research and development of new innovative technologies like, among others, the treatment through ionizing radiation (gamma or electrons).

44028 (INIS-mf–11597) **Radiation emitting devices regulations: Consolidated Regulations of Canada 1979, Chapter 1370.** Canada. 1970. 83p. Order Number DE90615121. Source: NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The Radiation Emitting Devices Regulations are the regulations referred to in the Radiation Emitting Devices Act and relate to the operation of devices. They include standards of design and construction, standards of functioning, warning symbol specifications in addition to information relating to the seizure and detention of machines failing to comply with the regulations. The radiation emitting devices consist of the following: television receivers, extra-oral dental x-ray equipment, microwave ovens, baggage inspection x-ray devices, demonstration–type gas discharge devices, photofluorographic x-ray equipment, laser scanners, demonstration lasers, low energy electron microscopes, high intensity mercury vapour discharge lamps, sunlamps, diagnostic x-ray equipment, ultrasound therapy devices, x-ray diffraction equipment, cabinet x-ray equipment and therapeutic x-ray equipment.

44029 (JAERI-M–89-228, pp. 79-87) **Radiation vulcanized natural rubber latex is not cytotoxic.** Nakamura, Akitada (National Inst. of Hygienic Sciences, Tokyo (Japan)); Ikarashi, Y.; Tsuchiya, T.; Kaniwa, M. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

It has been reported that urethritis and/or urethral strictures caused by urinary catheters relates to cytotoxicities of their materials, and that natural rubber latex (NRL) materials often show the strong cytotoxicities. This paper reports the cytotoxicity testing method using chinese hamster V79 cultured cells, clarifies that the toxicities of NRLs vulcanized by the conventional processes are due mainly to the contents of zinc dialkyldithiocarbamates in the materials, and that the cytotoxicity of radiation vulcanized NRL (RVNRL) is very weak. (author).

44030 (JAERI-M–89-228, pp. 91-99) **Progress in radiation vulcanization of natural rubber latex through international cooperation.** Makuuchi, Keizo (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research

Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

In 1982 IAEA implemented a regional Project of RVNRL as a part of Cooperation Program for Asia and the Pacific region. Bangladesh, China, India, Indonesia, Japan, Malaysia, Sri Lanka, Thailand and Vietnam are now participating in the Project. The work plan of the Project consists of R and D program, products development program and cost estimation of RVNRL. The main achievement of the R and D program are (1) reduction in vulcanization dose from 40 kGy to 8 kGy and (2) improvement in the quality of products. The advantages of RV NR latex rubbers over NR latex rubbers vulcanized using sulfur are (1) absence of nitrosamine, (2) low cytotoxicity, (3) absence of sulfur and zinc oxide, (4) transparency, and (5) softness. Test production of various rubber products such as condom, surgical gloves are being carrying out in each participating country. In March 1989 rubber gloves for workers in nuclear power plants have been commercialized in Japan. Optical laser balloon for diagnosis and treatment of gastric cancer and drainage are also developed in Japan. Three types of irradiators were designed for the cost estimation of RVNRL. (author).

44031 (JAERI-M–89-228, pp. 100-110) **Latex industry and RVNRL development in Malaysia.** Sidek, B.D. (Rubber Research Inst. of Malaysia, Kuala Lumpur (Malaysia)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Malaysia, as the largest producer of NR, exported 72.9 % of World's total export of 455,000 tonnes NR latex in 1987. In 1988, it has also become one of the largest consumers of NR latex, consuming 61,063 tonnes and producing 1.34 billion pairs of gloves, 45.5 million units of catheters and other latex products. Malaysia began active research and development of RVNRL only recently and much of which is through its participation in the UNDP/RCA project on RVNRL. Commercialization of RVNRL in Malaysia is expected to begin once its technical and economic merits and market potential have been established and demonstrated. It is suggested that a world-wide marketing study be undertaken to access the actual market potential of RVNRL. Companies intending to commercialize RVNRL may collaborate with UTN and RRIM to develop the commercial process for RVNRL. (author).

44032 (JAERI-M–89-228, pp. 111-117) **RVNRL in Europe.** Niepel, H. (MAPA G.m.b.H., Zeven (Germany, F.R.)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Natural rubber latex industry in Europe, especially in West Germany is faced with nitrosamine restriction. Nitrosamines are generated unavoidably by the conventional vulcanization process using dithiocarbamates as vulcanizing agents. There are two aspects of nitrosamine regulation, namely concentrations in environment and rubber products. Radiation vulcanized rubber will be an alternative to conventional basic substances especially for the production of consumer goods being in contact with food and human body. It is desirable to find the most effective irradiation process and to investigate the chemical components of the sensitizer and reaction products after irradiation and processing. (author).

44033 (JAERI-M–89-228, pp. 118-123) **Use of radiation vulcanized natural rubber latex in small and medium scale industries in Sri Lanka.** Karunaratne, S.W. (Rubber Research Inst., Ratmalana (Sri Lanka)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The latex based industry is fast growing with the setting up of several units to produce household and examination gloves. Production of rubberized coir using concentrated latex is also growing rapidly while more and more small scale industries have been set up. There is also a growth in the large scale sector in the dipped goods manufacture. Use of irradiated latex in the manufacture of dipped products has good potential as the efficiency of production is enhanced in the case of latex containing less additives. (author).

44034 (JAERI-M–89-228, pp. 127-131) **Commercialization of protective rubber gloves by radiation vulcanization.** Tsushima, Kyogo (Okamoto Industries Inc., Ryugasaki, Ibaraki (Japan)); Makuuchi, K.; Yoshii, F.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The processes for radiation vulcanization and production of protective rubber gloves for radioactive contamination are described. A newly developed sensitizing system consisting of 5 phr n-butyl acrylate was used to vulcanize natural rubber latex at 12 kGy. Transparent and soft gloves were obtained from the radiation vulcanized latex by a coagulant dipping process. The mechanical properties of the gloves meet Japanese Industrial Standard specification for protective gloves. Combustion analysis of the gloves revealed that the amount of evolved sulfur oxide and remaining ashes are less than those from sulfur vulcanization gloves. A usage of the gloves in a nuclear power plant showed that the gloves were easy to use in delicate work without undergoing fatigue. (author).

44035 (JAERI-M–89-228, pp. 132-145) **Development of condom and gloves from radiation vulcanized natural rubber latex.** Sundardi, F. (National Atomic Energy Agency, Jakarta (Indonesia). Pasar Djumat Research Centre); Marga Utama; Iskandar, Sudrajat; Herwinarni. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Study on radiation vulcanisation of natural rubber (NR) had been carried out since early of 1970. The positive result guided it to the establishment of a latex irradiator in 1983. This installation was designed for studying the economic aspect of radiation vulcanised of natural rubber latex (RVNRL), as well as for training and demonstration. After years of experiences in using that installation, it appeared that a lot of improvement should be done before transfering that technology to industry. Further development being done and a significant success has been achieved: characteristic of NR latex, antioxidant for RVNRL, new sensitizer, and cost analysis of RVNRL. A combination of n-BA and CCl_4 or n-BA alone showing a promising new sensitizer, which will be able in reducing the irradiation cost of NR latex. In order to introduce this technology to rubber gloves industry, a study of producing rubber gloves from RVNRL, a survey of the consumption of rubber gloves by the Hospital in Indonesia, and personal contact with rubber gloves industries have been done. The physical properties of rubber gloves prepared from RVNRL was reported to meet the Indonesian Standard of Industry. A comparison study with conventional sulfur vulcanisation has been done using the same of NR latex. According to the survey, the consumption of rubber gloves in the Hospital throughout Indonesia was about 3.5 million pairs, in with each pair was used for several times. A number of new rubber gloves companies which was established in this year (1989) was directed to meet the world consumption of examination rubber gloves. The total estimated capacity was about 1000 million/year. Several of those companies having a formal co-operation with BATAN in the development of the application of RVNRL. (author).

44036 (JAERI-M–89-228, pp. 146-156) **Commercial irradiation of natural rubber latex.** Saito, T. (Radia Industry Co. Ltd., Takasaki, Gunma (Japan)); Koike, G.; Sato, Y.; Takehisa, Masaaki. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Cost of irradiation is one of the important factor to expand industrial application of radiation vulcanized natural rubber latex (RVNRL). The irradiation cost was studied under the RCA project, RAS/8/061/1109, and reasonable cost was reported by use of single purpose latex irradiation facility of 1500 ton/year. For a market development of RVNRL, irradiation of latex of the order of 100 ton/year may be required. Construction of the single purpose pilot plant of this scale is not commercially feasible. In this stage use of contract irradiation facilities which are familiar world wide gives a solution. Radia Industry Co., Ltd. have two irradiation facilities with 1.4 MCi of Co-60 and irradiate natural rubber latex for Okamoto Industries, Inc. with use of the incremental dose irradiator which is commonly used for sterilization of medical supplies. Natural rubber latex filled in standard 20 liter plastic bags are loaded on the hanger of trolley conveyer, and irradiated without agitation. The dose uniformity was around 2, and properties of the RVNRL was reported satisfactory. The dose uniformity can be improved if special container is applied. In future it is expected to construct a larger single purpose irradiation plant to provide low cost irradiation for multi-client, or import RVNRL from RCA countries provided transportation test is successful. We have interest in electron beam valcanization. Radia Industry Co., Ltd. put an order 5 MeV, 150 kW electron beam machine and it will be operational in 1990. High penetration of 5 MeV electron beam is useful for radiation processing in the condensed media like natural rubber latex. (author).

44037 (JAERI-M–89-228, pp. 157-163) **Effect of non-rubber components on sensitized RVNRL.** Mohid, Norjanah (Unit Tenaga Nuklear, Bangi, Selangor (Malaysia)); Makuuchi, K.; Yoshii, F.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Attempts were carried out to establish the actual roles of non-rubber components in NR latex in the efficiency of the radiation vulcanization. Several types of latexes including centrifuged, creamed and deproteinized latexes were used for the work. The effect of varying amounts of nitrogen content of latex, in particular, once-, twice-and triple-centrifuged latexes were observed. The results obtained indicate the presence of inhibitor and accelerator for the radiation vulcanization process. (author).

44038 (JAERI-M–89-228, pp. 164-168) **Selection of Thai latex for radiation vulcanization.** Siri-Upathum, C. (Chulalongkorn Univ., Bangkok (Thailand)); Suchiva, K.; Chwajarernpun, J. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Radiation vulcanization of 7 different sources of concentrated latex found to give the maximum tensile strengths of the rubber film from 15-26 MPa at vulcanization doses of 10-22 KGy. The sensitizer used was a mixture of 5:1 phr of 2 EHA and CCl_4 at concentration of 6 phr. Attempt was made to correlate protein content in latex with vulcanization dose and with maximum tensile strength of the rubber film obtained. Experimental results showed that rate of vulcanization varied inversely with the protein content. Rough estimation of the optimum protein content for which highest tensile strength of the film might obtain was about 1.0 - 1.2% on total solid content. (TSC). (author).

44039 (JAERI-M–89-228, pp. 169-177) **Characteristics of natural rubber latex from Indonesia.** Marga Utama (National Atomic Energy Agency, Jakarta (Indonesia). Pasar Djumat Research Centre); Sundardi, F.; Herwinarni; Sumarti, M.; Iskandar, S.; Iramani, D.; Makuuchi, K.; Yoshii, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Five field latexes from different clones have been characterized. The total solid content increases and the protein content decreases with increasing the age of rubber trees. The average particle size is between 190 and 234 nm. The number average molecular weight varies from 160,000 to 700,000 while the weight average molecular weight varies from 1,000,000 to 500,000. Negligible difference was observed in the physical properties of rubber films prepared from the irradiated field latexes. (author).

44040 (JAERI-M–89-228, pp. 178-188) **Effect of non-rubber solids and stabilizing agents on radiation vulcanization of natural rubber latex.** Thomas, E.V. (Rubber Board India, Kerala (India)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Natural rubber latex contains non-rubber substances like proteins, resins and carbo-hydrates along with the rubber hydrocarbon. Vulcanization of rubber present in latex is brought about by heating latex with chemicals like sulphur and accelerators. Radiation from γ-source is also used in vulcanizing natural rubber latex. The effect of non-rubber sustances on vulcanization by radiation from a γ-source is reported in the paper. Non-rubber content in latex can be varied by centrifuging it or by mixing pure chemical equivalents of non-rubbers with it. In order to obtain lattices with varying non-rubber contents both procedures were used in the study. Stability of natural latex is controlled within desirable limits by addition of certain colloidal stabilisers. The effect of popular stabilisers on production of RVNRL was also investigated in the paper. Latex was vulcanized by exposing it to radiation source in presence of sensitisers. Dry films were prepared from RVNRL produced under different trials. These films were tested for their tensile strength, modulus and crosslink density. Results of the study indicate that the non-rubbers present in natural rubber latex have to significant effect on crosslinking by radiation. It was further observed that lattices with comparatively lower non-rubber contents yielded RVNRL of better physical properties. (author).

44041 (JAERI-M–89-228, pp. 189-197) **Technological evaluation of radiation pre-cured NR latex.** Gazeley, K.F. (Malaysian Rubber Producer's Research Association, Hertford (UK)); Pendle, T.D. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

This paper describes the evaluation, in technological terms, of a radiation vulcanized natural rubber latex concentrate supplied by the Takasaki Radiation Chemistry Research Establishment. The latex was used to prepare cast films, coagulant dipped and heat-sensitive dipped films. The processing behavior of the latex in these operations was observed and the tensile properties of the films were determined. The film-forming behaviour of the latex in film casting was normal and the properties of the cast films, after leaching, were very good. The heat-ageing behaviour at 70 degC was inferior to that of sulphur prevulcanized films but may be sufficiently good for many applications. The latex behaved well in the coagulant dipping process and gave films of adequate tensile strength and improved ageing resistance, compared with the cast films. It is believed that the differences observed between the cast and coagulant-dipped films may be artefactual but further work may be required to confirm this idea. The latex proved difficult to use in a

PVME heat-sensitive process due to its colloidal stability characteristics. The physical properties of the films obtained were inferior to those of the cast and coagulant-dipped films. The latex was found to be free of detectable nitrosoamines and to have only a trace of nitrosatable amines and should therefore be suitable for use in several products where these factors are important. (author).

44042 (JAERI-M–89-228, pp. 198-206) **Thermoplastic elastomers by radiation grafting on NR latex and its extrusion molding.** Ono, Seiji (Hiroshima Kasei Ltd., Fukuyama (Japan)); Yoshii, F.; Makuuchi, K.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Thermoplastic elastomer (TPE) was synthesized by radiation grafting of methyl methacrylate (MMA) onto radiation vulcanized natural rubber latex (NRL) with n-butyl acralate (n-BA). The processability test of MMA grafted rubber for TPE was carried out as follows. The MMA grafted rubber was masticated by a two-roll mill to enhance the processability and was then mixed with 0.5 phr of antioxidant and process oil in a kneader. The compound was milled at 150degC to get a sheet. The processability was evaluated by observing the surface flatness of milled sheet. The optimum concentration of MMA for tensile strength was 50 phr. The hardness is increased with increasing MMA concentration and was around 50 (shore A) for the compound with 10 phr of process oil. The tubing was produced from this TPE compound using an extruder with a tube die, 9 mm external diameter and 6 mm internal diameter at 150degC. The melt flow of this compound was good enough to produce a smooth surface. The diameter of the tube produced was almost the same as the die size. From these results, it appears that the MMA grafted rubber becomes a TPE by kneading after mastication and its extrusion molding is possible. (author).

44043 (JAERI-M–89-228, pp. 207-215) **Effect of coagulant on mechanical properties of radiation vulcanized NR latex film.** Saito, T. (Radia Industry Co. Ltd., Takasaki, Gunma (Japan)); Yoshii, Fumio; Makuuchi, K.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

We have produced protective rubber gloves for radioactive contamination from vulcanized natural rubber latex with monomer (n-butyl acrylate). Properties of vulcanized NR film cast onto glass plates were lower than that of rubber gloves prepared by coagulant dipping. In order to find out the cause of this difference in physical properties, the effect of coagulant on these properties was investigated. Physical properties of cast film from radiation vulcanized NRL with 5 phr of 2-ethylhexyl acrylate/1 phr CCl_4 increased remarkably by immersion in a 10 % $Ca(NO_3)_2$ solution. The crosslink density of the $Ca(NO_3)_2$-treated film was higher than that of the untreated film. From FTIR measurement, it was found that ammonium carboxylate ($-COO^-NH^+_4$) in vulcanized NR converted to calcium carboxylate ($-COO^-CA^{2+}-^-OOC-$) by $Ca(NO_3)_2$ treatment. Furthermore, from the photographs of the cross section of the treated film by x-ray microanalyzer, calcium was detected. From these results, it is ascertained that the increase in physical properties by coagulant dipping is attributed to the inter particle crosslinking through Ca^{2+} ion. Thus, it clearly demonstrated that the $Ca(NO_3)_2$ leaching is favorable for the enhancement of physical properties of vulcanized NR. (author).

44044 (JAERI-M–89-228, pp. 216-224) **Effect of heating and leaching on mechanical properties of radiation vulcanized natural rubber latex film.** Shukri bin Hj. Ab. Wahab (Rubber Research Inst. of Malaysia, Selangor (Malaysia)); Makuuchi, K.; Devendra, R.; Pansa, C-P. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The effect of heating and leaching on the mechanical properties of radiation vulcanized natural rubber latex (RVNRL) film was investigated. It was found that heating and leaching improved tensile strength of film considerably. The tensile strength could increase as high as 25 % upon heating alone and as high as 75 % upon leaching and drying. The increase in the tensile strength was attributed to reduced moisture content, better particle cohesion and improved entanglement of molecular chains. Complete leaching and drying of RVNRL was found to be important to obtain better and consistent results on the mechanical properties of films from RVNRL. (author).

44045 (JAERI-M–89-228, pp. 225-233) **Standardization of radiation vulcanized natural rubber latex.** Karunaratne, S.W. (Rubber Research Inst., Ratmalana (Sri Lanka)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Standards for concentrated latex used in the preparation of irradiated latex, standard irradiation conditions, further treatment of irradiated latex, level of prevulcanization and its estimation, film preparation and testing procedures are discussed in this paper. (author).

44046 (JAERI-M–89-228, pp. 234-244) **Effect of antioxidant on the aging property of rubber film prepared from radiation vulcanized natural rubber latex.** Sumbogo, D.E. (Universitas Gadjah Mada, Jogyakarta (Indonesia). Fakultas Teknik); Sundardi, F.; Utama, M. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

A study of the effect of antioxidants on the aging property of film prepared from radiation vulcanised natural rubber latex (RVNRL) has been done. Commercial antioxidants studied were Vulcanox, Ionol and Nonox. Two kinds of RVNRL were studied, those which prepared by using CCl_4 and n-butyl acrylate (n-BA) sensitizers. The antioxidants were in the form of emulsion and dispersion before blending with the latex. The antioxidants were blended with NR latex just after irradiation. It was found that the addition of Vulcanox, Ionol or Nonox, in the form of emulsion or dispersion into RVNRL, would much improve the aging property of the film. Emulsion of Vulcanox (0.5 phr) appeared to be the best antioxidant for RVNRL prepared using CCl sensitizer. Decreasing in tensile strength after 14 days of aging at 70degC was 17.9 % compared to 26.5 % for film without that antioxidant. Emulsion of Vulcanox also showing the best sensitizer for RVNRL prepared using n-BA sensitizer. (author).

44047 (JAERI-M–89-228, pp. 245-259) **Stabilization of radiation vulcanized natural rubber latex film.** Shukri bin Hj.Ab. Wahab (Rubber Research Inst. of Malaysia, Selangor (Malaysia)); Siti, S.B.S.; Makuuchi, K.; Devendra, R.; Pansa, C-P. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Radiation vulcanized natural rubber latex (RVNRL) film has poor aging characteristics especially after it has been subject to leaching. The effect of the addition of antioxidants on the aging properties of RVNRL obtained using carbon tetrachloride and n-butyl acrylate (n-BA) as sensitizers respectively were evaluated. Antioxidant 2'2'-methylene-bis-(4-methyl-6-tert-butylphenol) containing 0.8 phr was found to be the most effective for RVNRL produced by using CCl_4 as sensitizer and antioxidant 2,4-Bis[(octylthio)methyl]-o-cresol containing 1.0 phr for RVNRL

produced by using n-BA as sensitizer. Antioxidant 2-mercaptobenzimidazole showed slightly less effective but gave less tendency for discolouration compared to 2.4-Bis[(octylthio)methyl]-o-cresol when used in the n-BA system. (author).

44048 (JAERI-M–89-228, pp. 268-289) **Sensitization in radiation grafting, curing and vulcanization processes.** Garnett, J.L. (New South Wales Univ., Kensington (Australia). School of Chemistry); Dworjanyn, P.A.; Bett, S.J.; Dang, H.P. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195– : 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Common parameters between radiation grafting, curing and vulcanisation processes are discussed. Additives for accelerating all three processes are reported. Acrylate monomers, particularly multifunctional acrylates, are sensitisers for the three reactions. These monomers (i) increase yields in grafting under certain radiation conditions (ii) speed up rates of polymerisation and cross-linking in the cure process, and (iii) lower the radiation dose required to achieve vulcanisation of natural rubber latex. Basic studies of electron interactions with these acrylate monomers using Fourier Transform ion cyclotron resonance mass spectrometry indicate that ionic reactions may contribute to the currently accepted free radical polymerisation mechanism involved in all three radiation processes. Based on curing work, the toxicological properties of acrylate, particularly multifunctional acrylates, are shown to be important when these monomers are used in vulcanisation processes. For this purpose, the guide lines (Draize values) developed for curing processes are of relevance to vulcanisation. (author).

44049 (JAERI-M–89-228, pp. 290-304) **Combination effect of carbon tetrachloride with 2-ethylhexyl acrylate as a sensitizer for radiation vulcanization of natural rubber latex.** Devendra, R. (Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka)); Makuuchi, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Investigation showed that a combination of 2-ethylhexyl acrylate (2-EHA) and carbon tetrachloride as a sensitizer system for radiation vulcanization of natural rubber latex is effective to reduce the vulcanization dose. This combination is effective over a wide range so that it can be selected depending on the radiation cost and chemical cost. Swelling data indicate that the addition of carbon tetrachloride to 2-EHA increases the efficiency of the crosslinking reaction. A combination of 1 phr carbon tetrachloride and 1 phr 2-EHA will lead to a more economical system than the system using 5 phr carbon tetrachloride as sensitizer. (author).

44050 (JAERI-M–89-228, pp. 305-318) **Selection of hydroperoxides as co-sensitizer for n-butyl acrylate.** Parinya, A. (Prince of Songkla Univ., Hat-Yai, Songkla (Thailand)); Makuuchi, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

A hydroperoxide was selected as a co-sensitizer for n-butyl acrylate (n-BA) in the presence of potassium hydroxide (KOH) in natural rubber latex to reduce the irradiation dose for vulcanization. n-BA used together with a hydroperoxide was more effective as sensitizer for latex vulcanization. The latex prepared by adding hydroperoxide before adding n-BA was more stable than the latex with n-BA alone. From four hydroperoxides studied, t-butyl hydroperoxide exhibited high vulcanization efficiency at low concentration and at a low dose of 8 kGy. (author).

44051 (JAERI-M–89-228, pp. 319-325) **Effect of hydrogen peroxide on the radiation vulcanization of natural rubber latex sensitized with carbon tetrachloride and n-butyl acrylate.** Sabarinah, Y.S. (National Atomic Energy Agency, Jakarta (Indonesia). Pasar Djumat Research Centre); Sundardi, F. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195– : 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

An investigation to reduce the optimum irradiation dose for the radiation vulcanization of natural rubber latex (RVNRL) by the addition of hydrogen peroxide before irradiation had been carried out. The optimum irradiation dose decreased slightly while the maximum tensile strength of the RVNRL film increased slightly with the addition of a small amount (2.5 phr of 30% solution) of hydrogen peroxide. The crosslink density of the RVNRL film also decreased slightly with increased addition of hydrogen peroxide. However excessive amount of hydrogen peroxide added caused reduction in the film tensile strength and crosslink density. (author).

44052 (JAERI-M–89-228, pp. 326-335) **n-butyl acrylate as a sensitizer for radiation vulcanization of natural rubber latex.** Chen, Zhonghai (Ministry of Chemical Industry, Zhuzhou, HN (China). Research Inst. of Latex Industry); Makuuchi, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

As a sensitizer for radiation vulcanization of NR latex n-butyl acrylate (n-BA) has several advantages such as high sensitizing efficiency and easiness of removal of residue by drying. However n-BA tends to destabilize NR latex. A study to stabilize NR latex against n-BA has been carried out. The most effective stabilizer is potassium hydroxide. By the addition of 0.2 phr KOH the stability of NR latex is sufficiently improved to withstand the addition of 5 phr n-BA. The sensitizing efficiency of n-BA is so high that the vulcanization dose is 15 kGy with 5 phr n-BA without the addition of carbon tetrachloride as a co-sensitizer. The radiation vulcanized NR latex has enough stability for a 90 days storage. (author).

44053 (JAERI-M–89-228, pp. 336-349) **Radiation vulcanization mechanism of liquid isoprene with 2-ethylhexyl acrylate.** Siri-Upathum, C. (Chulalongkorn Univ., Bangkok (Thailand)); Makuuchi, K.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The mechanism of radiation vulcanization of liquid isoprene rubber (LIR) with 2-ethylhexyl acrylate (2-EHA) monomer has been investigated as part of a development of new sensitizer for radiation vulcanization of natural rubber latex (RVNRL). To elucidate the mechanism, intermediate products formed during the vulcanization were isolated and determined for their chemical functionalities by ^{13}C-NMR and FT-IR techniques. The intermediate products isolated were confirmed to contain chemical functionalities both from LIR and 2-EHA with vinyl double bond still existed. This suggested that the crosslinking to form three-dimensional network was through the grafted products of 2-EHA onto the backbone of LIR while the unreacted pendant double bonds in 2-EHA molecules served as the reactive sites for such crosslinking. (author).

44054 (JAERI-M–89-228, pp. 350-357) **Radiation vulcanization of natural rubber latex using 300 keV electron beam machine.** Sofiarti, W. (National Atomic Energy Agency, Jakarta (Indonesia). Pasar Djumat Research Centre); Utama, Marga; Sundardi, F. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

A study has been done on radiation vulcanization of natural rubber (NR) latex using an Electron Beam (EB) Machine of 300 keV.

The penetration range of the beam in NR latex is between 0.3 mm and 0.4 mm. The effect of sensitizer was also studied. The optimum dose of irradiation is about 250 kGy for NR latex without sensitizer, while using 4 phr of CCl_4 as a sensitizer the optimum dose decreases to about 140 kGy, and to about 120 kGy by using a mixture of CCl_4/n-BA as sensitizer. A NR latex having a green strength of the film about 2 MPa was used in this experiment, which yielding a maximum tensile strength about 18 MPa for the film prepared from the irradiated NR latex. A tensile strength of about nine time of its green strength has been achieved. A comparison study with the film prepared from Co-60 irradiation of NR latex has been made. It was found that without sensitizer, the optimum dose of irradiation was almost the same, which was about 250 kGy. Sensitizing effect of CCl_4 or a combination of CCl_4/n-BA were not as good as in gamma irradiation. It was concluded that EB irradiation of NR latex showing almost the same effect as gamma irradiation, except the small effect of sensitizer for EB irradiation of NR latex. (author).

44055 (JAERI-M–89-228, pp. 358-367) **Radiation vulcanization of natural rubber latex with 3 MeV electron beams, 1.** Chen, Zhonghai (Ministry of Chemical Industry, Zhuzhou, HN (China). Research Inst. of Latex Industry); Makuuchi, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The sensitized radiation vulcanization of natural rubber latex has been carried out with a 3 MeV, 25 mA Dynamitron electron accelerator. Latex was irradiated over a range of dose rate from 0.3 to 60 kGy/sec in the presence of sensitizers such as n-butyl acrylate, 2-ethylhexyl acrylate, and 1,6-hexanediol diacrylate. The sensitized vulcanization of NR latex with electron beams is greatly affected by dose rate. The vulcanization dose increases with increasing dose rate. The maximum tensile strength of rubber films from the irradiated latex decreases slightly with increasing dose rate. There is negligible effect of dose rate on the viscosity of the irradiated latex. (author).

44056 (JAERI-M–89-228, pp. 368-377) **Radiation vulcanization of natural rubber latex with 3 MeV electron beams, 2.** Sooriyarachchi, S.S. (Atomic Energy Authority, Colombo (Sri Lanka)); Makuuchi, K.; Yoshii, F.; Ishigaki, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

A kinetic study has been made on the sensitized radiation vulcanization of natural rubber latex with high dose rate electron beams. The rate of vulcanization (R_{vul}) depends on the sensitizer concentration (M) and the dose rate (I). Following equation was obtained. $R_{vul} = k\ M^{0.5}\ I^{0.75}$ An advantage of the high dose rate vulcanization is found in aging properties. The rubber film prepared from the electron beams vulcanized NR latex was superior to those prepared from gamma-rays vulcanized NR latex. (author).

44057 (JAERI-M–89-228, pp. 378-382) **Application of RVNRL in europe.** Bez, W. (Kautschuk-Gesellshaft, Frankfurt am Main (Germany, F.R.)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Due to strict regulation of nitrosamines in environment and rubber products, development of a nitrosamine free vulcanization process is desired. A study has been carried out on RVNRL with electron beams. A Dynamitron electron accelerator was used for RVNRL at 1.5 MW and 20 and 25 mA. The vulcanization dose is 60 kGy with 5 phr trimethylolpropane trimethacrylate. Several kinds of rubber products such as surgical gloves, urinal condoms, and cork soles were produced from the radiation vulcanized latex and evaluated by latex customers. Good running properties were reported. However it was requested to increase tensile strength and to reduce stickiness and permanent set. (author).

44058 (JAERI-M–89-228, pp. 383-394) **An alternative option study of Malaysian latex irradiator.** Muhd Noor Bin Muhd Yunus (Unit Tenaga Nuklear, Bangi, Selangor (Malaysia)). Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

A Technical study and evaluation was made to select the best alternative to Malaysia with egard to Latex Irradiator at experimental scale. Some cost comparison which lead to economic evaluation was also done. The two option in so far considered were between utilising multipurpose Irradiator against purchasing a category I dry storage Irradiator, both for the above intention. Finally a recommendation to utilise the existing multipurpose Irradiator was made due to technical and economical merits. (author).

44059 (JAERI-M–89-228, pp. 395-403) **Improved dry type irradiator.** Japan Atomic Energy Research Inst., Tokyo (Japan); Japan Atomic Industrial Forum, Inc., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

The dry type irradiator designed by Aggarwal has been redesigned and reevaluated. Major improvements were made in the three points, namely the shielding structure of building, the handling of radiation source, and the handling of reactor vessel. The labyrinth system is replaced by the fit-in type shielding door. The bottom loading system of radiation source is changed to the top loading system. The reaction vessel is carried into the irradiation cell while the fit-in type shielding door is left open. As a result, the processing cost is reduced from $0.8 to 0.23/kg. (author).

44060 (JAERI-M–89-228 v. 260-267) **Development of surgical gloves from radiation vulcanized natural rubber latex.** Nguyen Quoc Hien (National Inst. for Nuclear Research, Da Lat (Viet Nam)); Doan Binh; Vo Tan Thien; Le Hai; Nguyen Tan Man; Vo Thi Thanh. Japan Atomic Energy Research Inst., Tokyo (Japan). Jan 1990. (CONF-8907195–: 1. international symposium on radiation vulcanization of natural rubber latex, Tokyo (Japan), 26-28 Jul 1989). In *Proceedings of the international symposium on radiation vulcanization of natural rubber latex.* Order Number DE90798860. Source: NTIS (US Sales Only), PC A18/MF A01.

Natural rubber latex (55% DRC) containing 3 phr of CCl_4 was irradiation γ-rays from Co-60 source at a dose rate of 7.5 kGy/h. Specifications of irradiated latex and mechanical properties of the radiation vulcanized latex were studied. The maximum tensile strength which was obtained at 25 kGy was 240 kg/cm^2. The viscosity of the irradiated latex kept constant value under 30 kGy. The G value for crosslinking calculated from swelling is 17.0. Chlorine contents measured with activation analysis increased with increasing irradiation dose. 400 kg of latex was vulcanized at 25 kGy and used for production of rubber gloves in an existing factory with coagulant dipping process. The physical properties of the rubber gloves were as follows: tensile strength; 220-250 kg/cm^2, elongation at break; 950%, permanent set; 5-10%, aging residual tensile strength after at 70degC for 72 hours; 70-80%. The gloves were accepted for domestic use as surgical and examination gloves. (author).

44061 (SAND–90-2120C) **All-organic, optically clear, radioluminescent lights.** Renschler, C.L. (Sandia National Labs., Albuquerque, NM (USA)); Shepodd, T.J.; Clough, R.L.; Gill, J.T.; Tompkins, J.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009201–3: Radioluminescent technology conference, Annapolis, MD (USA), 25-26 Sep 1990). Order Number DE90015695. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe the development of the first all-organic, opitcally clear, radioluminescent (RL) light. Although gas-phase RL lights have been known for many years, a number of advantages accrue to solid state devices. These include greater ruggedness and ease of brightness scale-up. In our systems, tritium is covalently bound to an organic getter, which is dissolved in an organic monomer, along with appropriate scintillating dyes. The entire system cures by monomer polymerization due to the radiation field, resulting in a clear, glowing solid plastic block. We outline here the design considerations employed in producing these materials. 12 refs., 1 fig.

0703 Isotopic Power Supplies

Refer also to citation(s) 44134

0705 Health and Safety

Refer also to citation(s) 44064

08 HYDROGEN

0801 Production

Refer also to citation(s) 44630

44062 (EUR–12412) **Production of hydrogen for the hydrogenation of heavy oil and coal: Demonstration project.** Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; VEBA-Oel AG, Gelsenkirchen (Germany, F.R.). 1989. 63p. Sponsored by Commission of the European Communities. Contract LG 01/10/80. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 6.25.

The aims of the overall project were the planning, construction and industrial testing a commercial-size entrained-flow gasification plant for the generation of hydrogen, which can be operated on solid fuels, e. g. pyrolysis coke and coal just as well as on liquid hydrogenation residues. The objective was the determination of data enabling an evaluation of the technical feasilibility, the possibilities for official approval and the economic viability of the demonstration plant before the final decision on its construction was taken. Parallel to the planning of the demonstration plant, gasification test were to be made in an existing pilot plant. These tests were to demonstrate the design data for the demonstration plant as well as to test and to improve the extruder feeding-system and the gasification burner. 14 figs., 3 tabs.

44063 **Deuterium concentration and cold fusion: Rate distributions in palladium.** Rogers, V.C. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)); Sandquist, G.M.; Nielson, K.K. *Fusion Technology (USA)*, 16(4): 523-525 (Dec 1989).

Cold fusion reactions and excess heat production have been reported in the electrolysis of heavy water with a palladium metal cathode. Solution of the standard diffusion equation for deuterium without fusion indicates that the deuterium concentration distribution rapidly becomes constant in the palladium lattice. Solution of the nonlinear diffusion equation for deuterium undergoing fusion also gives constant deuterium concentrations, suggesting that any fusion occurs uniformly throughout the palladium lattice. The hypothesis that fusion reactions occur predominantly at the palladium surface is shown to be inconsistent with experimental data.

0805 Health and Safety

44064 (KCP–613-4410) **Hydrogen-tritium getters and their applications.** Shepodd, T.J.; Smith, H.M. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Aug 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-9009201–4: Radioluminescent technology conference, Annapolis, MD (USA), 25-26 Sep 1990). Order Number DE90016282. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The accumulation of hydrogen is usually an undesired event. Large leaks from hydrogen storage and handling facilities pose explosion hazards. Small amounts of hydrogen that may build up in sealed containers after long storage times can damage internal components. Any tritium leak is an immediate health hazard. Hydrogen scavengers or getters can avert all of these potential problems by irreversibly removing hydrogen from such environments. Early hydrogen getters were metals that, though effective, were sensitive to oxygen. More recent work with crystalline organic materials has yielded formulations that will scavenge hydrogen in the presence or absence of air. They commonly utilize a catalyst to add hydrogen across of carbon-carbon double or triple bond. Because of the instability of organic materials to ionizing radiation, a getter that will be stable after reaction with tritium is a further challenge. We will describe hydrogen getter materials and systems developed at Sandia National Laboratories and at Allied-Signal, Kansas City Division. These materials have the proven ability to scavenge and contain hydrogen and tritium. The technologies are based on the irreversible removal of hydrogen by catalytic hydrogenation of unsaturated organic compounds. 6 refs.

09 BIOMASS FUELS

44065 (DOE/OR/21389–27) **Northeast Regional Biomass Energy Program progress report, April 1990–June 1990.** O'Connell, R.A. CONEG Policy Research Center, Inc., Washington, DC (USA). Jul 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE90015062. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This document discusses activities during this reporting period. The management structure and program objectives for the Northeast Regional Biomass Program remain unchanged from previous years. The funding for this year however has been considerably reduced permitting the issuance of grants to states to be held to $15, 000/State. It also meant that fewer projects could be undertaken in the technical subcontract area. To alleviate this condition, $120, 000 of unobligated state agent funds has been transferred to the technical subcontract area. Technical projects have been selected by the Steering Committee. Work statements are in preparation. The Biofuels and Municipal Waste Technology Division has advised that the Northeast Regional Biomass Program (NRBP) will receive $610, 000 of fiscal year 1990 funds to contract future programs. Also discussed are research and management highlights, Technical grants, Technical subcontracts, and Technology Transfer.

44066 (DOE/OR/21390–27) **Great Lakes Regional Biomass Energy Program: Quarterly report, December 1, 1989–February 28, 1990.** Kuzel, F. Council of Great Lakes Governors, Chicago, IL (USA). Mar 1990. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21390. Order Number DE90015071. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the second quarterly report of the seventh year of operation of the Great Lakes Regional Biomass Energy Program. The program was initiated in 1983 with a grant to the Council of Great Lakes Governors from the Biofuels and Municipal Waste Technology Division of the US Department of Energy. Stressing near-term biomass feedstock production techniques and conversion processes, the objective of the program is to increase the use of biomass energy by the public and private sectors in the seven state Great Lakes region. States that are in the Great Lakes region include: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin. During this quarter, technical assistance programs were expanded in several states. Iowa implemented a Biomass Prefeasibility Program by analyzing the potential for installation of biofueled cogeneration systems at two sites. Three contractors began making sites visits in Minnesota to assist operators of woodfired boiler plants make necessary corrections so that these plants can be properly operated at full capacity. Ohio plans to institute a computer-based assistance program for biomass combustion and alcohol fuel production systems. Technology transfer continued to

be a major emphasis of the program. Three papers were presented at the Institute of Gas Technology's Energy from Biomass and Wastes XIV conference dealing with wood waste-to-energy, anaerobic digestion for energy recovery, and d-RDF emissions testing projects that were undertaken in the region. Newsletter articles, fact sheets, and brochures were published by the Illinois, Iowa, Minnesota, and Wisconsin state programs. In addition, biomass and other alternative forms of energy made a significant contribution to "Iowa at the Crossroads ," the comprehensive energy plan for the state of Iowa.

44067 (DOE/OR/21390–28) **Great Lakes Regional Biomass Energy Program: Quarterly report, March 1, 1990–May 31, 1990.** Kuzel, F. Council of Great Lakes Governors, Chicago, IL (USA). Jun 1990. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21390. Order Number DE90015072. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the third quarterly report of the seventh year of operation of the Great Lakes Regional Energy Program. The program was initiated in 1983 with a grant to the Council of Great Lakes Governors from the Biofuels and Municipal Waste Technology Division of the US Department of Energy. Stressing near-term biomass feedstock production techniques and conversion processes, the objective of the program is to increase the use of biomass energy by the public and private sectors in the seven state Great Lakes region. States that are in the Great Lakes region include: Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio and Wisconsin. Future planning was a major emphasis of the program this quarter. Thirty-one members of the Technical Advisory Committee met in Chicago and proposed a wide variety of projects which may be undertaken through the Subcontractor component. Demonstration, technology transfer, and market development projects were suggested within the broad areas of forestry, municipal waste, and agricultural products/residue. In addition, the states of Indiana and Michigan completed state-specific planning efforts for their biomass energy programs, while the "Iowa at the Crossroads" comprehensive energy plan for the state of Iowa was widely distributed throughout that state and nationwide. Major technology transfer endeavors this quarter included the "Waste-to-energy and recycling in Wisconsin: Lessons for the '90s" seminar cosponsored by the Wisconsin biomass program, participation by the Ohio biomass program at the 87th Annual Meeting of the Ohio Forestry Association/Ohio Society of American Foresters, and publication and distribution of a report on the results of d-RDF emissions tests conducted in Iowa. Additional newsletter/journal articles, fact sheets, and brochures relating to biomass energy were published by the Illinois, Iowa, Minnesota, Ohio, and Wisconsin programs.

0907 Resources

44068 (ORNL/Sub–85-27409/5) **Selection and improvement of herbaceous energy crops for the southeastern USA: Final report on a field and laboratory research program for the period March 15, 1985 to March 14, 1990.** Bransby, D.I. (Auburn Univ., AL (USA). Dept. of Agronomy and Soils); Sladden, S.E.; Kee, D.E. Oak Ridge National Lab., TN (USA); Auburn Univ., AL (USA). Dept. of Agronomy and Soils. Jul 1990. 76p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90014769. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The general aim of this research program was to screen herbaceous species and evaluate management practices for biomass production on marginal soils in Alabama and the southeastern USA. The program started with a 5 year evaluation of selected warm-cool season species rotations. Rainfall during the 5-year program was mostly below the long-term average, except in 1989 when it was above normal. Due to low rainfall yields of perennial species took longer than expected to reach full production potential, increasing each year throughout the 5-year program. "Cave-in-Rock" switchgrass, sericea lespedeza and johnsongrass provided the highest yields from the warm season perennial species. The most significant trend in biomass composition was the notably high lignin and nitrogen content of sericea lespedeza when compared to the perennial grass species. During the course of the program additional experiments were initiated which new species and additional varieties of switchgrass. Napiergrass and energy cane provided yields from 24 to 32 Mg biomass ha^{-1} in the second and third year after establishment, but sustainability of these yields are uncertain because no severely cold weather was experienced during the experimental period. In the second year after establishment "Alamo" switchgrass yielded 17.5 Mg biomass ha^{-1}. This progress represented a major improvement on yields and production costs when compared to the original experiments. If yields of this level can be sustained and possibly improved a little more it is likely that the production basis for an economically viable herbaceous biomass-to-biofuel industry will be achieved in another 5 years. Future work should concentrate on optimizing management factors such as row spacing and harvesting regime, and on improving yield by plant breeding and selection. 5 refs., 3 figs., 29 tabs.

44069 (ORNL/Sub–85-27413/5) **Perennial species for optimum production of herbaceous biomass in the Piedmont: Final report, 1985–89.** Parrish, D.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA)); Wolf, D.D.; Daniels, W.L.; Vaughn, D.H.; Cundiff, J.S. Oak Ridge National Lab., TN (USA); Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Jul 1990. 115p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90014784. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

We have investigated eight biomass candidates grown on marginal Piedmont sites. The species include four grasses; sorghum-sundangrass hybrid, switchgrass, weeping lovegrass, and tall fescue; and four legumes: birdsfoot trefoil, crownvetch, flatpea, and sericea lespedeza. The candidate species were planted using no-till methods on twelve sites underlain by three different soils, Davidson, Cecil, and Appling. Initial establishment was good, but some plots had to be replanted after freezes and/or drought reduced stands. The two warm-season perennial grasses, switchgrass and weeping lovegrass, consistently provided the most biomass across all sites; average biomass yields in years following establishment ranged from 8 to 16 Mg/ha for the two. The legumes were generally lower than the grasses in biomass production, with sericea being the most productive legume overall, averaging about 6 Mg/ha/yr. Other studies indicated the experimental sites were quite variable in key soil morphological and chemical characteristics. Rooting depth of switchgrass was particularly notable, exceeding 0.7 m in all the soils studied. Erosion estimates using the Universal Soil Loss Equation suggested no-till production of perennial species limits soil losses. Economic analyses showed distinct differences among the candidates in costs of production. Physiological studies of switchgrass seed dormancy and photosynthesis were also conducted. 19 refs., 11 figs., 49 tabs.

44070 (PI–PI-X-77F) **Guidelines for forest biomass inventory.** Aldred, A.H.; Alemdag, I.S. Petawawa National Forestry Inst., Chalk River, ON (Canada). 1988. 115p. (MICROLOG–90-02800). Source: PC Forestry Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This manual presents guidelines for including forest biomass assessment in forest inventory. The purpose of the guidelines is to draw together a uniform set of definitions, standards, and procedures that recognize current forest inventory practice and which are practical and simple to use. A general description is provided of biomass measurement, including how it relates to the larger inventory problem. The description includes, where necessary, background, definitions of terms, equations, references, examples, and theoretical considerations. The manual addresses sampling designs, which determine where to select the samples, how much data to collect, and how to use readily available data to increase efficiency of sampling. Field and laboratory procedures are then presented for measuring and recording basic data, developing equations for estimating biomass quantities from easily-measured tree variables, and applying biomass estimation models to forest inventory. 63 refs., 13 figs., 28 tabs.

0908 Production

Refer also to citation(s) 44068

44071 (DOE/OR/21389–28) **Evaluation of residual stand damage following whole-tree partial cutting in northern forest types.** Cline, M.L. (Maine Audubon Society, Falmouth, ME (USA)); Hoffman, B.; Cyr, M. CONEG Policy Research Center, Inc., Washington, DC (USA). Jun 1990. 70p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE90015063. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A market for low-quality wood chips for biomass boilers in recent years has evoked mixed reactions from both the public and the forestry community. The increased demand for rough, rotten, and cull trees for fuelwood presents opportunities to improve timber stand quality in the Northeast forest. In the past, only the best trees were harvested in the past leaving the poorer quality ones to develop into the next forest, a practice called high-grading. The new market for low-quality wood offers an opportunity to reverse the adverse impacts of high-grading. The present study was designed to quantify the amount of residual stand damage that occurs when whole-trees are harvested during thinning or partial cut operations, and to correlate the extend of damage with several important variables of silvicultural management. A total of 18 hardwood or mixed wood study sites were selected in Maine, New Hampshire, and Vermont that were harvested within the last five years using wheeled, drive-to-bunch harvesting machines.

44072 (ORNL/Sub–85-27412/5-P1) **Evaluation of potential herbaceous biomass crops on marginal crop lands: 1, Agronomic potential: Final report, 1985–1989.** Cherney, J.H. (Purdue Univ., Lafayette, IN (USA). Dept. of Agronomy); Johnson, K.D.; Volenec, J.J.; Kladivko, E.J.; Greene, D.K. Oak Ridge National Lab., TN (USA); Purdue Univ., Lafayette, IN (USA). Dept. of Agronomy. Jul 1990. 34p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Contract 19X-27412C. Order Number DE90015708. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Management of herbaceous biomass crops must be investigated concurrently with the development of cost-effective conversion processes. Our objective was to evaluate the agronomic feasibility of several combinations of species and management systems for producing herbaceous biomass on sites ranging from good to marginal cropland. Soil organic matter and aggregate stability were not adversely affected by any of the management options. Of the perennial grasses and legumes investigated, switchgrass showed the most potential as a biomass candidate. It has minimum fertilizer inputs, is very persistent, and is effective in reducing soil erosion. Sorghum double-cropped with winter annual rye was very productive, but required more inputs than switchgrass. Interseeding sorghum into perennial grasses was not a viable option, due to its great dependence on environmental variables. Photoperiod-sensitive and hybrid sorghums able to utilize an entire growing season were very productive, with yields up to 39 Mg ha^{-1}. Two harvest per season resulted in low yields, such that lodging resistance must be incorporated into desirable genotypes through breeding, instead of using multiple harvests to prevent lodging. Plant composition was greatly affected by species, with a wide range in composition across sorghum genotypes. Of all species evaluated, switchgrass and sorghum have the greatest biomass potential, and both of these species can be improved to produce higher yields of a more desirable chemical composition through plant breeding. 13 refs., 11 figs., 8 tabs.

44073 Oceanic farming of Macrocystis: The problems and non-problems. North, W.J. (California Inst. of Tech., Pasadena, CA (US)). pp. 39-68 of Seaweed cultivation for renewable resources. Bird, K.T.; Benson, P.H. Elsevier Science Pub. Co., Inc., New York, NY (USA) (1987).

This paper reports on research on open ocean farming of Macrocystis. A literature survey of marine plants provided the basis for selecting species to be tested for biomass production in offshore settings. This study led to a decision to undertake research using the giant brown kelp, Macrocystis as the primary test organism with sufficient flexibility to switch to other species if preliminary results indicated the need for alternatives. Subsequent work confirmed the suitability of Macrocystis, so other algae were not investigated.

44074 Cultivation of Gracilaria and other macroalgae in Florida for energy production. Hanisak, M.D. (Harbor Branch Oceanographic Institution, Fort Pierce, FL (US)). pp. 191-218 of Seaweed cultivation for renewable resources. Bird, K.T.; Benson, P.H. Elsevier Science Pub. Co., Inc., New York, NY (USA) (1987).

This paper reports that the state of Florida has over 2,000 km of diverse coastline which supports a rich and diverse subtropical and tropical marine flora and that cultivation of seaweeds would appear suitable in these waters where a mild, subtropical climate allows year-round growth of many macroaigal species. However, commercial cultivation of seaweeds does not yet exist in Florida. The author discusses the importance of macroalgae as a possible natural resource in Florida.

0909 Processing

Refer also to citation(s) 43679, 44082, 44552

44075 (DOE/ER/13715–2) **Bioconversion technology at the Oregon Graduate Center: Annual report, 2nd year.** Gold, M.H. Oregon Graduate Center, Beaverton, OR (USA). Dept. of Chemical and Biological Sciences. Apr 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER13715. Order Number DE90016126. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research programs in biotechnology are briefly described. Topics include molecular biology of the lignin degradative system; biochemical studies on manganese and lignin peroxidases; plant cell wall proteins; lignin biosynthesis in woody plants; oxidative enzymes involved in cellulose degradation; and studies on lactases from white rot fungi. 8 refs. (CBS)

44076 (DOE/ER/13924–3) **Anaerobic O-demethylation of phenylmethylethers: Progress report.** Frazer, A.C.; Young, L.Y. New York Univ. Medical Center, NY (USA). Microbiology Dept. [1990]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13924. Order Number DE90015934. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Anaerobic O-demethylation (AOD) of phenylmethylethers is a process of both basic and applied significance. The aryl-O-methyl ethers are abundant in natural products, particularly as components of lignin. They are present as methoxylated lignin monomers in anaerobic environments and can be completely degraded there by mixed microbial populations. AOD is an essential early step in this process, and it is also a key reaction in the utilization of the O-methyl substituent as a C-one substrate by acetogens. An understanding of the AOD reaction mechanism might suggest new ways in which chemicals could be derived from lignocellulosic materials. The biochemical mechanism for the anaerobic cleavage of the aryl-O-methyl ether bond is an intriguing, but relatively unexplored process. In contrast to aerobic O-demethylating enzymes, AOD appears to involve methyl group transfer. Thus, novel biochemical information on an important biotransformation reaction will be gained from the research proposed. Recently, we have shown that AOD activity is inducible and have developed an assay for detecting AOD activity in cell-free extracts of Acetobacterium woodii. AOD activity is stimulated in vitro by the addition of ATP (1mM) and pyruvate (30 mM), the K_M for vanillate being 0.4 mM. In collaboration with protein purification experts, we proposed to purify the AOD enzyme and characterize the protein(s) and the enzymatic reaction involved. 8 figs., 5 tabs.

44077 (EGG-M–89498) **A critical review and evaluation of bioproduction of organic chemicals.** Leeper, S.A.; Andrews, G.F. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-900512–3: 12. symposium on biotechnology for fuels and chemicals, Gatlinburg, TN (USA), 7-11 May 1990). Order Number DE90015465. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Dependence on petroleum as the primary feedstock for production of chemicals cannot continue indefinitely. Bioconversion could provide an alternate route to production of organic chemicals. A wide range of commodity chemicals and potentially-new chemicals

can be produced via bioconversion of biomass. However before large-scale bioproduction of organic chemicals becomes a reality, issues related to economics, feedstock availability, environment, and energy requirements must be addressed. In this paper, these issues are discussed and promising potential candidates for bioproduction are identified. Research needs are briefly addressed. 35 refs., 5 tabs.

44078 (PB–90-231101/XAB) **Strengthening of the essential oil industry in Korea. Technical report: Design of modern chemical equipment for the production and processing of essential oils.** Langner, S. United Nations Industrial Development Organization, Vienna (Austria). 2 May 1989. 72p. (V–89-55233). Source: NTIS, PC A04/MF A01.

The report is on technology and equipment for production and processing of essential oils in Korea DPR and covers: (1) production of such oils by extraction steam or water distilling; (2) stage of development reached in the country; and (3) vacuum film evaporation; (4) batch vacuum rectification equipment.

44079 (PB–90-240375/XAB) **Molecular biology of one-carbon metabolism in anaerobic bacteria. Annual report, January 1989-December 1989.** Ferry, J.G. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Jan 1990. 89p. Source: NTIS, PC A05/MF A01.

Biochemical and molecular genetic approaches were used to study one-carbon reactions in the pathway for conversion of acetate to methane in Methanosarcina thermophila. Phosphotransacetylase, an enzyme involved in the activation of acetate, was characterized; factors were identified which determined the activity and synthesis of the enzyme. The mechanism of carbon-carbon bond cleavage of acetate was better understood by studying the reverse reaction, synthesis of activated acetate from one-carbon precursors. Ferredoxin and HSHTP were shown to be involved in electron transport. The gene encoding the ferredoxin was isolated and partially sequenced. New enzyme activities were discovered that may participate in the pathway. The molecular genetics of one-carbon metabolism was further studied by sequencing the formate dehydrogenase operon from Methanobacterium formicicum.

44080 **Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 1.** Energy systems. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. 1.275p. University of Delaware, Newark, DE (USA) (1989). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

This book contains the proceedings from the International Symposium, Energy Options for the Year 2000, Volume 1 Energy Systems. Topics covered included: Community based energy policies, Energy systems-the utility sector, District heating and cooling systems, Energy from recycling, and Energy from forest products.

44081 **Biomass pyrolysis oil feedstocks for phenolic adhesives.** Chum, H. (Solar Energy Research Inst., Golden, CO (US)); Diebold, J.; Scahill, J.; Johnson, D.; Black, S.; Schroeder, H.; Kreibich, R.E. pp. 135-154 of Adhesives from renewable resources. Hemingway, R.W.; Conner, A.H. American Chemical Society, Washington, DC (USA) (1989). (CONF-870802–: 194. American Chemical Society national meeting, New Orleans, LA (USA), 30 Aug - 4 sep 1987).

This paper reports that fast pyrolysis of pine sawdust in a small vortex reactor operating at 10 to 20 kg/h and 480 to 520 °C produces high yields of primary pyrolysis oils (over 55% by weight on a dry basis). The vortex reactor transmits very high heat fluxes to the sawdust, causing primarily depolymerization of the constituent polymers into monomers and oilgomers. A preliminary scheme separates the raw oils into a carbohydrate-derived aqueous fraction and a phenolic-rich ethyl acetate (EA) soluble fraction. The EA fraction is washed with water and with aqueous sodium bicarbonate to remove acids yielding 20% to 25% of the feed as phenols and neutrals (P/N) in the EA solution. After EA evaporation, a novolak formulation with 50% phenol and 50% of the P/N fraction was successfully prepared. Gel times for the P/N fractions suitably prepared are intermediate between resorcinol and traditional phenol-formaldehyde resins.

0910 Properties and Composition

Refer also to citation(s) 44072

44082 (CONF-8906350–1) **Manipulation of wood chemical traits for energy: An assessment.** Ranney, J.W. (Oak Ridge National Lab., TN (USA)); Turhollow, A.F.; Dinus, R.J. Oak Ridge National Lab., TN (USA). [1989]. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Workshop on the improvement of feedstock quality; Toronto (Canada); 29 Jun 1989. Order Number DE90015181. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A comparative assessment of the biological potential to modify wood for improved conversion to liquid and gaseous fuels identifies specific gravity, lignin and hemicellulose qualities, bark quantity, and hemicellulose content as priority research targets. However, the difference in priorities of 10 characteristics is minimal. When biological opportunities are compared to biofuel conversion priorities, bark quantity and specific gravity fall in priority and concern for lignin content rises. The major conclusion of the comparison is that an assortment of many minor changes hold the greatest and most practical promise. The economic benefit of these potential improvements needs evaluation. The qualities of productivity (growth) and disease/pest tolerance and resistance continue to exist as a major concerns against which energy trait modifications must have little negative effect. 34 refs., 7 tabs.

0920 Combustion

Refer also to citation(s) 44552, 44581, 44582, 44583, 44600, 45293

44083 (PB–90-221946/XAB) **Application of staged combustion and reburning to the co-firing of nitrogenated wastes: Chemical and biological analyses. Report for July 1987-March 1990.** Linak, W.P.; McSorley, J.A.; Hall, R.E.; Srivastava, R.K.; Ryan, J.V. Acurex Corp., Research Triangle Park, NC (USA). ©1990. 38p. Source: NTIS, PC A03/MF A01.

The paper gives results of an evaluation of a 0.6 MW precombustion chamber burner, designed for in-furnace NOx control and high combustion efficiency (CE) for high nitrogen content waste co-firing. The 250- to 750-ms residence time precombustion chamber burner mounted on a prototype water-tube package boiler simulator used air staging and in-furnace natural gas reburning to yield up to four stoichiometric zones. Natural gas doped with ammonia and No. 2 distillate fuel oil doped with pyridine were used to simulate high nitrogen content fuel/waste mixtures. Minimum NO emission levels correspond to about 85% reduction in NOx emissions compared to uncontrolled emissions from a conventional swirl burner mounted on a 0.7-MW commercial package boiler. CO emissions for these burner characterization tests indicated CEs>999%. The low NOx precombustor was then used to examine the co-firing characteristics of a nitrogenated pesticide containing dinoseb in a fuel-oil/xylene solvent. The dinoseb formulation as fired contained 6.4% nitrogen. NO emissions without in-furnace NOx control exceeded 4400 ppm (at 0% O2). When NOx controls in the form of air staging and natural gas reburning were employed, these emissions were reduced to < 150 ppm (96% reduction). Average CO and total hydrocarbon emissions were typically < 15 and 2 ppm, respectively.

44084 (PB–90-872458/XAB) **Waste-to-energy facilities. November 1976-May 1990 (A Bibliography from the NTIS data base). Report for November 1976-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 188p. Source: NTISPC N01/MF N01.

Supersedes PB–89-855142.

This bibliography contains citations concerning technical, economic, and environmental evaluations of facilities that convert waste to energy. Solid waste and municipal waste conversion facilities are highlighted. Feasibility studies, technical design, emissions studies, and markets for the resulting energy are discussed. Heat and electrical generation facilities are emphasized. (This updated

bibliography contains 358 citations, 125 of which are new entries to the previous edition.)

44085 Chain mechanisms in the overall reaction orders in laminar flame propagation. Egolfopoulos, F.N. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering); Law, C.K. *Combustion and Flame (USA)*, 80(1): 7-16 (Apr 1990).

The laminar flame speeds of methane-oxygen-nitrogen mixtures as functions of the flame temperature T_{ad} and system pressure p have been experimentally determined by using the counterflow, twin-flame technique. These data are then compared with numerically-calculated values obtained by using an independently validated kinetic scheme. Results show that the overall reaction order n and activation energy $_a$ are far from being constants, that n decreases with increasing p and decreasing T_{ad} whereas $_a$ increases with increasing p, and that n can actually assume negative values; the last result implies that the mass burning rate of some weakly burning flames may decrease with increasing pressure. By further identifying the crucial reaction steps through sensitivity analysis, the results are interpreted on the basis of the influence on chain branching-termination mechanisms on the overall reaction rate.

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 44069, 44072

44086 (CAS–90-2-1) **Wood energy for Alabama.** Ziemke, M.C. Alabama Univ., Huntsville, AL (USA). Coll. of Administrative Science. Feb 1990. 37p. Sponsored by University of Alabama-Huntsville. Source: OSTI; College of Administrative Science, The University of Alabama in Huntsville, Huntsville, AL 35899.

The Science, Technology and Energy Division of the Alabama Department of Economic and Community Affairs embarked in 1983 on a program to increase the industrial/commercial use of biomass-derived fuel to help achieve the goal of energy independence for Alabama. Almost all of the biomass fuel used in this program to date has been in the form of residue from the forest products industry. Besides replacing a non-renewable fuel, utilizing Alabama's wood residue provides a number of advantages to the state: making Alabama more competitive and profitable, decreasing disposal cost of unsold wood residue, conserving valuable landfills, creating jobs by increasing company profitability and increasing the tax base because of increased company profits. Currently, an annual production of thousands of tons of wood products residue is not being utilized. When we have found a use for this type of wood residue, we can began to utilize the huge amount of wood residue left in the forests after timber cutting operations. As a result of some of the technology transfer arising from implementation of this program, it has been possible to provide the Alabama forest products industry with firsthand information on new and possibly more profitable methods of operation. Some of this information has been transferred through news media publicity, workshops and technical publications resulting from the biomass fuel project. In 1986, a booklet on "Case Studies in Cost Savings" was provided by ADECA to serve this purpose. In this booklet, the original five projects were featured as "Case Studies 1–5." To further this effort, this updated case studies booklet was created to relate additional results of the Biomass Fuel Development Program. 34 figs., 5 tabs.

44087 (GAO/NSLAD–89-106) **Fuel ethanol: Imports from Caribbean Basin initiative countries.** General Accounting Office, Washington, DC (USA). National Security and International Affairs Div. Feb 1989. 42p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the Omnibus Trade and Competitiveness Act of 1988 which requires GAO to examine fuel ethanol imports from Central America and the Caribbean and their impact on the U.S. fuel ethanol industry. Ethanol is the alcohol in beverages, such as beer, wine, and whiskey. It can also be used as a fuel by blending with gasoline. It can be made from renewable resources, such as corn, wheat, grapes, and sugarcane, through a process of fermentation. This report finds that, given current sugar and gasoline prices, it is not economically feasible for Caribbean ethanol producers to meet the current local feedstock requirement.

0950 Environmental Aspects

Refer also to citation(s) 44071

0980 Waste Management

Refer also to citation(s) 44571

0990 Products and By-Products

Refer also to citation(s) 44068

10 SYNTHETIC FUELS

1002 Production

44088 (EUR–12440) **Production of ethanol or other fuel molecules by anaerobic fermentation in fixed-cell reactors of gas produced by lignocellulose gasification: Final report.** Nyns, E.J. (Universite Catholique de Louvain, Louvain-la-Neuve (Belgium)); Naveau, H.P.; Beckers, G.H. Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 40p. Sponsored by Commission of the European Communities. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg.

Literature data suggest that ethanol or other (fuel) molecules can be produced by anaerobic fermentation of synthesis gas obtained by gasification of lignocellulose material. Reactor design studies focussed on study of gas transfer under fluidized bed reactor conditions. Preliminary results were obtained with a pilot-scale fluidized bed reactor specially adapted to gaseous feedstocks and conducted under non-axenic conditions with a massive inoculum of Acetobacterium wieringae. With a CO_2/H_2 mixture, a gas-feedstock consumption yield of up to 84% was obtained at a space loading rate of 3.1 kg COD per m^3 of bioreactor working volume per day. Under higher space loading rates, gas-feedstock tansfer rates of up to 8.4 kg COD per m^3 of bioreactor working volume per day were obtained. With a CO_2–H_2–CO feedstock mixture, a production rate of up to 2.9 kg volatile fatty acids (as COD) per m^3 of bioreactor working volume per day was achieved. Carbon monoxide was consumed in preference to carbon dioxide. The feasibility of the new proposed process of carbon monoxide containing syngas fermentation has been proved. The major problems to be solved for the process to ever become economic have been elicited. These are concerned with the gas transfer rate enhancement and the active biomass retention in the bioreactor. 13 refs., 26 figs.

44089 (IFP–37-310) **Study of morphologic and catalytic properties of cobalt base solids for synthesis of alcohols.** Bailliard-Letournel, R.M. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France). 1989. 128p. (In French). Order Number DE90514537. Source: NTIS (US Sales Only), PC A07/MF A01.

For direct synthesis of a mixture of methanol and higher alcohols from synthesis gas (CO, H_2) catalysts are studied by successive additions of promotors (Cu, Zn and CuZn oxides) to a cobalt aluminate to decrease hydrocarbon formation. After a bibliographic study on catalysts for alcohol synthesis: experimental techniques, preparation and study of catalysts, study of carbon monoxide and hydrogen adsorption and study of the reaction CO and H_2 under pressure are examined.

44090 (UWO/FES–90-03960) **Application of the pseudoadiabatic reactor to the conversion of synthesis gas into blending stocks: Final report.** Lasa, H. de; Simard, F.; Mayay, A.; Ravella, A. Western Ontario Univ., London, ON (Canada). Faculty of Engineering and Science. Feb 1989. 438p. Contract EMR 23440-6-9192/01-ST. (MICROLOG–90-03960). Source: PC Dept. of Industry, Science and Technology (ISTC), Library (CLIB), 235 Queen St., Ottawa, ON, CAN K1A 0H5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont.,

Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A bi-functional catalyst was successfully developed with the dual function of methanol synthesis and methanol conversion. The following catalyst composition was chosen: 63% Zn/Cr (25/75 atomic ratio), 27% H-ZSM-5 zeolite and 10% Versal 950 alumina binder. The transformation of synthesis gas takes place such that methanol is formed and readily converted on the zeolite component. Catalyst characterization shared some valuable insights on the states of the Zn and Cr as well as on the role of their oxides. Experimental runs were made in a pilot plant unit to confirm the possible application of the novel pseudoadiabatic reactor concept for the selective conversion of synthesis gas into gasoline-range hydrocarbons. Typical operating conditions were 20-34 atm and 350-400°C, allowing speculation on the economic advantages of this system. It was observed that pseudoadiabatic operation was obtained consistently for most of the runs, indicating simple design and scale-up rules. Between 12 and 17% of the CO converted into liquid hydrocarbons, in some cases with the C_5^+ fraction reaching 73% of the total hydrocarbons produced. The methane fraction in the hydrocarbons was found to be under 4.51%. Kinetic models were also developed for the various synthesis and conversion reactions investigated. It was observed that the predictions of reactor regime using the kinetic model for the biofunctional catalyst and computer simulation confirmed experimental observations in the pilot plant. Computer program listings for the various reaction models are included. 17 refs., 3 figs., 35 tabs.

44091 **Iron catalyst for preparation of polymethylene from synthesis gas.** Sapienza, R.S.; Slegeir, W.A. To Dept. of Energy, Washington, DC (USA). USA Patent 4,904,700/A/. 27 Feb 1990. Filed date 22 Mar 1989. USA Patent Application 7-327,465. Int. Cl. C07O 1/02. 8p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an invention that relates to a process for synthesizing hydrocarbons; more particularly, the invention relates to a process for synthesizing long-chain hydrocarbons known as polymethylene from carbon monoxide and hydrogen or from carbon monoxide and water or mixtures thereof in the presence of a catalyst comprising iron and platinum or palladium or mixtures thereof which may be supported on a solid material, preferably an inorganic refractory oxide. This process may be used to convert a carbon monoxide containing gas to a product which could substitute for high density polyethylene.

1003 Properties and Composition

Refer also to citation(s) 43854

1007 Economic, Industrial, and Business Aspects

Refer also to citation(s) 44493, 44602

1009 Environmental Aspects

Refer also to citation(s) 44602

13 HYDRO ENERGY

Refer also to citation(s) 44423

44092 (EMR/V/CRE–CE02911) **Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.** Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. 360p. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This conference covers the various aspects of small hydroelectric power plants: public policy, research programs, private power development, licensing hydrology, civil works, electro-mechanical equipment, control systems, financing, project management, project historical aspects, and case studies Canada and USA. A research and development program of the Government of Canada in Power of renewable energy sources in general is also described. Lists of the participants and of the exhibitors at the associated trade show are provided. Separate abstracts have presented for 18 papers.

44093 (EMR/V/CRE–CE02911, pp. 161-168) **A postscript to the advanced hydrology workshop.** Seagel, G.C. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper summarizes some of the main points of an advanced hydrology course held in Vancouver in April 1987 and provides the reader with sources of information and ideas resulting from the discussions. The subjects covered were regional hydrology and rainfall/run-off relationships as applied to ungauged streams, and field methods of measurements, weirs, rainfall and snowfall monitoring, observation of the sediments content of the water and of the characteristics of the basin. Information sources are listed. The potential impacts of a project on fish habitat, spawning, rearing and migration should not be ignored. 5 refs.

44094 (EMR/V/CRE–CE02911, pp. 261-265) **Small hydro civil work experience.** Breckon, J. (Appropriate Power Engineering Corp. West Vancouver, BC (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper describes the activities of the Appropriate Power Engineering Corp. (APEC), which was formed primarily to foster small hydro development. Its main focus is on the civil works portion of small hydro developments which present the greatest potential for savings. In addition to a great deal of hydro-power-related knowledge, the particular expertise of APEC lies in the hydrological assessment of basins, the hydraulics of rivers and structures, the design of dams, intakes, pen-stocks and all types of other water passages, and in the particular effects of cold weather. A number of in-house computer programs exist to assist in the assessment of such aspects as hydro power potential at a site, cost estimates, and pipeline design, including the potential for freezing in pipelines. Other project-specific programs can be developed. The on-going projects in which APEC participates include the Tarrant Creek project, a 60 kW hydro plant currently being installed at a coastal forest camp, and the Black Rock project, a 400-600 kW intergrated hydro/diesel installation to service communities on the Alaskan highway.

1301 Resources and Availability

44095 (EC/WSC–EN36-418/1988-6) **Historical streamflow summary, Yukon and Northwest Territories, to 1988.** Environment Canada, Ottawa, ON (Canada). Water Survey of Canada. 1989. 167p. (MICROLOG–90-02137). Source: PC Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Yukon Territory and the Northwest Territories for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as 1902 in the Yukon, when hydrometric surveys were concerned with navigation; regular hydrometric work began in 1944 by the Dominion Water and Power Bureau of the federal government. Current survey data are collected by the Water Survey of Canada in cooperation with the federal Department of Indian Affairs and Northern Development, and assisted by other

public agencies and private organizations concerned with water resources. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station within each territory.

44096 (EC/WSC–EN36-418/1988-8) **Historical streamflow summary, Quebec, to 1988.** Environment Canada, Ottawa, ON (Canada). Water Survey of Canada. 1989. 402p. (MICROLOG–90-02787). Source: PC Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

A summary is presented of monthly and annual mean discharges, and annual extremes of discharge, for rivers in Quebec for which streamflow data to 1986 inclusive have been collected. Data are presented for the entire period of record, as far back as 1906, when hydrometric surveys were carried out by the Quebec Department of Lands and Forests. In 1913, surveys were taken over by a Waterways Commission and later by federal agencies. Current survey data are collected mainly by the Quebec environment ministry, assisted by other public agencies and private organizations concerned with water resources, such as Hydro-Quebec. This document also contains descriptive information about gauging stations, such as location, drainage area, and whether the flow is natural or regulated. Data are arranged alphabetically by name of gauging station.

44097 (EMR/V/CRE–CE02911, pp. 197-210) **Hydrologic design methodologies for small scale hydro at ungauged sites. Phase IIA, British Columbia.** Howard, C.D.D. (Charles Howard and Associates Ltd., Victoria, BC (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The feasibility studies of hydroelectric projects normally require power production studies based on stream flow data, but, for many projects, and particularly for small-scale hydro, such data are not available. A synthetic record of stream flows can be developed but in the mountainous terrain of British Columbia, this is not a simple task. A micro-computer software package, IMP (Integrated Method for Power Analysis), designed to address this problem is discussed. The scope of the package, the data needed to run a case and the meaning and accuracy of the results (stream flow, low flows and floods) are discussed. British Comubia is divided into 6 hydrographic regions for the purpose of the calculations. IMP consists of 5 basic components that are contained in 9 programs; these components are an atmospheric model of annual precipitation (PRECIP), a watershed model (BSCIM), a flood frequency analysis system (FFA), a hydroelectric power simulation program (POP), and a graphical presentation package (GAP). IMP is a package of computer programs which are integrated through a common menu and data base. The package was compiled from BASIC and runs under the operating system MS-DOS 2.1 on an XT-compatible micro-computer. 2 figs., 1 tab.

44098 (EMR/V/CRE–CE02911, pp. 169-194) **Synthetic hydrology generation for feasibility level evaluations of small-scale hydro at ungauged sites in Atlantic Canada.** Keefe, J.D.A. (Water Planning and Management Branch, Environment Canada, Halifax, NS (Canada)); Judge, D.G.; Anderson, J.E.; Hill, I.K. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The plant design and the economic return from a small-scale hydro project are very dependent upon both the average stream flow and the pattern of the stream flow throughout the year. Consequently, feasibility level evaluations are best performed by simulating plant performance using data from a long period of stream flow. Unfortunately, many potential sites are located at an ungauged location, and a synthetic stream flow record must be generated. In recognition of this need for a methodology to generate a suitable synthetic stream flow record, a study was undertaken by Acres International Limited for the Inland Waters Directorate of Environment Canada in 1984-1985. Various synthetic flow generation schemes are compared and methodologies described that have been incorporated into computer models which are available for use in selected hydrologic regions of Atlantic Canada. The simulations use readily available data and generate a synthetic daily flow record that preserves the characteristics that would be used directly, or converted to energy using part of the program package. Simplified procedures to estimate flood flows, required for spill-way design, are also presented. Test results are presented for one of the selected methodologies in the case of the Paradise River near Monkstain, Newfoundland. While this study focuses on small-scale hydro projects, the hydrological forecasting methodologies which were developed have application in any other activity where the stream flow pattern is of interest, such as water management, water quality investigations, and environmental impact assessments. 6 refs., 7 figs., 4 tabs.

44099 (EMR/V/CRE–CE02911, pp. 211-216) **The fuelling of small hydro power.** Clark, R.H. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper discusses the reliability of the stream flow data used for the sizing of small hydroelectric projects. The head may be determined at any time on the basis of existing topographical maps or a one-time field survey; on the other hand, the quality of the historical data base is critical in developing an accurate set of stream flow data. Four approaches are usually available for this purpose: direct measurement, direct transfer from a similar site, a hydrological model based on transferred parameters, and a hydrological model combined with direct measurements. The reliabilities of these approaches are compared, the last one being the most reliable. In planning a small hydro project, 3 kinds of uncertainties are to be considered: natural fluctuations, sampling uncertainty, and model uncertainty. Other characteristics of the stream than the stream flow may also require a detailed study, such as flood characteristics, sediment charcteristics and water quality, especially in view of the environmental consequences of the project.

44100 (GAO/RCED–90-2FS) **Federal electric power: Information concerning the Colorado River Storage Project.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 49p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the Colorado River Storage Project which is a major federal water project that delivers water to farmers, towns, and industries; provides flood control; and generates electricity at its hydropower plants. It provides information on project investment costs and repayments, revenues from power sales, power asset values, wholesale power rates (federal and nonfederal), and the modification of the planned Diamond Fork power system to enable it to provide commercial power.

44101 (ORNL/FTR–3683) **[Feasibility study of the San Lorenzo River hydroelectric project]: Foreign trip report, July 8–14, 1990.** Chronowski, R.A. Oak Ridge National Lab., TN (USA). 19 Jul 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90015707. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

I travelled to San Jose, Costa Rica on July 8, 1990 to evaluate all of the completed elements of the ongoing feasibility study for the San Lorenzo River hydroelectric project. The feasibility study is being supported by ORNL under the Renewable Energy Applications and Training Project. The project is being studied for

implementation by CONELECTRICAS, a consortium of rural electric cooperatives and the study itself is being conducted by BEL Engineering, a Costa Rican consulting firm under contract to CONELECTRICAS, USAID/PIC and NRECA.

1302 Site Geology and Meteorology

Refer also to citation(s) 44112, 44116, 44996

1303 Plant Design and Operation

Refer also to citation(s) 44996

44102 (EMR/V/CRE–CE02911, pp. 145-157) **Speed governing and voltage control for isolated hydro plants.** Newman, G. (KPL Hydro Power Systems Ltd., Richmond, BC (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper is a review of the methods used to govern or control the speed and voltage of small hydroelectric power plants operating alone, or connected to a small isolated electric system. Hydraulic turbines, governors, over-speed, electric generators, voltage regulators and frequency control are discussed. The paper is illustrated by the case of a small hydro power plant at Pelican Bay, Alaska. A number of technical terms are defined, and recommendations are made for the proper design of small hydro power plants.

44103 (EMR/V/CRE–CE02911, pp. 129-144) **Morant River Hydro Electric Project: A case history.** Lensink, H. (Barber Hydraulic Turbine Inc., Port Colborne, ON (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The Morant River Mini Hydro Electric Project is located on the East Arm of the Morant River, in the foothills of the Blue Mountain Range, 35 kilometers east of Kingston, Jamaica. The project consisted of the complete re-development, from dam to tail-race of an existing facility. The project is based on two 140 kW Francis turbines, which operate at 750 rpm under a net head of 18. The paper presents an overview of the project, outlining the civil, mechanical and electrical design, project construction, start-up, and operation. The problems encountered, both technical and logistical, are also discussed. This turn-key project was technically successful in that the plant and the associated equipment functioned according to the specifications. Based on the Jamaica experience, it is recommended that the turbine designer consistently look for design improvements to ease installation and maintenance, especially in plants in remote locations such as this. The engineering instructions for site construction and installation should be clear and concise and be implemented in strict accordance with the specifications. 3 figs.

44104 (EMR/V/CRE–CE02911, pp. 267-278) **Evaluation of syphon performance.** FitzPatrick, B. (Acres International Ltd., Niagara Falls, ON (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The objectives of this study were to investigate the intake geometry, submergence and performance of a laboratory syphon installation by evaluating the power output of a turbine-generator for poor intake conditions. The laboratory installation is described. The test series included the following: determination of the loss in power output from a turbine operating at maximum discharge for changes in submergence of 5 to 50 cm for 3 fixed elevations of the intake, and determination of the critical submergence of the intake for discharges of 30 to 120 l/s for 3 fixed elevations of the intake. The conclusions of the study are listed, including the fact that air entrainment played a significant role in reducing the power output of the turbine. It is hoped that the experimental data from this study will help to improve over the rule of thumb presently applied and which is based on dimensionless terms (minimal submergence/diameter of intake, and Froude number). A list of the 13 syphon hydro installations of Europe and North America is provided (head = 2.25 to 15 m, capacity = 80 to 3,000 kW). 17 figs., 1 tab.

44105 (EMR/V/CRE–CE02911, pp. 279-299) **Recently built small hydro projects in B.C. [British Columbia].** Fawkes, P. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The characteristics of 3 hydroelectric projects in British Columbia, ranging from 10 kW to 217 kW capacity, are presented. The projects illustrate non-standard designs, including a 10 kW home-made cross-flow turbine, steel pipe, centrifugal pumps used as turbines in reverse, and 15 kV underwater transmission cables. The heads range from 33 m to 110 m , penstocks from 15 cm polvinyl chloride to 76 cm steel, and capital costs from Cans 1340/kW to Cans 4270 kW. Design and layout, construction, operating experience and capital costs are discussed for each case. Detailed descriptions of these projects can be found in a more detailed publication from Energy, Mines and Resources of Canada. 1 refs., 6 figs., 7 tabs.

44106 (EMR/V/CRE–CE02911, pp. 219-260) **Design aspects of small hydro.** Gordon, J.L. (Monenco Consultants Ltd., Montreal, PQ (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This design manual for small-scale hydroelectric power plants begins by discussing the cost of such installations. A formula is proposed which relates cost to installed capacity and rated head. Design formulas and relevant technical references are provided for the following aspects of a project dams: spill-ways, canals, intakes, penstocks, power-house strutures, and tail-races. Prevention of water hammer and floods is discussed in detail. Calculations for the design of two plants are provided, one with a high head and one with a low head. 23 refs., 7 figs.

44107 (EMR/V/CRE–CE02911, pp. 317-322) **Small hydro mechanical electrical experience.** Taylor, T.P. (Dominion Bridge-Sulzer Inc., Lachine, PQ (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper is about the experience of Donimion Bridge-Sulzer (DBS) Corporation in the field of small hydroelectric power plants. DBS manufactures hydraulic turbine components designed by the Swiss company, Sulzer Escher Wyss. Five projects, located in Canada and in the USA, in which DBS has been involved are briefly described: Forth Lake, Eastman Falls, Maquatua, Dolgeville/Diana (2 sites), and Springfield; they range from 6.7 m to 22.7 m head and from 490 kW to 6500 kW rated power. All of these projects have one thing in common, the use of a pre-engineered standardized turbine. This is what DBS manufactures; all the other

supplies and services are provided to match the customer's needs. Small hydro requires a different approach from large hydro; in order to make it economically viable, the cost must be reduced wherever possible, by designing and building standardized turbines, by copying work done in other contracts, and by using modular or standard components. It is, therefore, advised to use a performance type of specification for a project, rather than detailed equipment specifications. 6 tabs

44108 (EMR/V/CRE–CE02911, pp. 303-312) **Electrical-mechanical difficulties for small hydro generation in B.C. [British Columbia].** Thomson, W.R. (Thomson and Howe Energy Systems, Kimberly, BC (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper is about the difficulties that tend to impede otherwise viable small hydroelectric projects in British Columbia. The following measures aid toward the goal of a successful installation: reliable preliminary site inspections, simple, cost-effective design, and early selection of a competent person to oversee procurement, installation, commissioning and early operation. The following aspects of improving the electro-mechanical design of small hydroelectric plants are mentioned: better load management, efficiency in the use of combined diesel-hydro power systems, and assessment of the reliability and need of repairs of the existing British Columbia installations.

44109 (PB–90-231499/XAB) **Preliminary designer's operating criteria: McPhee power plant, Dolores Project, Colorado.** Bureau of Reclamation, Denver, CO (USA). Jan 1990. 44p. Source: NTIS, PC A03/MF A01.

The purpose of the Designers' Operating Criteria is to provide operational and maintenance personnel with a fundamental knowledge of the overall scheme and to outline the basic operation and maintenance requirements for the facilities. The criteria first provide a general description of the facilities and their operation and then follow with a detailed description and discussion of the various systems involved. It is expected that exposure gained after a period of trial operation will enable operation and maintenance personnel to supplement these criteria with instructions posted in the powerplant. Information provided in these criteria apply only to McPhee Powerplant and do not include the outlet works of McPhee Dam or transmission facilities.

44110 (TAC–CE02875, pp. 37-44) **Drainage measures for hydropower station at Vargoen.** Carlsson, A. (Kraftbyggaarna Byggnadsteknik AB, Ludrika (Sweden)); Lintu, Y.; Olsson, T. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

A ground water monitoring programme has been implemented during the construction of the headrace tunnel and Vargoen's hydro power plant for an increase in generating capacity from 22 to 33 MW. During the course of the investigation very high water heads were observed in the rock walls which were regarded as harmful to the overall stability of the walls. As a consequence of the high water heads in the rock walls, a drainage system was designed in order to relieve the water head. A borehole gallery drilled from the tunnel was chosen as a suitable drainage measure in this respect. The design of the gallery was based on model calculations which defined the required length and borehole spacings. After drilling of boreholes leading to a drainage gallery, a control program was carried out for the remaining construction period. The results of the monitoring indicated that the drainage gallery fulfilled its function and that the water heads were reduced to an acceptable level, i.e., from about 15 m down to, 1 m close to the wall. 5 refs., 11 figs., 2 tabs.

44111 (TAC–CE02875, pp. 213-222) **The design of underground power houses.** Benson, R.P. (Klohn Leonoff Ltd., Vancouver, BC (Canada)); Walia, M. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

Chambers excavated in rock are safe, economical, and invisible structures for the construction of the hydroelectric power plant powerhouses. With new developments in engineering geology and rock mechanics, rational design approaches are now available. The design problems which are common to most underground powerhouses are set out in 2 categories, primary and secondary. The primary design problems are the location and orientation of the powerhouse complex, the shape and size of the openings, the excavation and support sequence, the design of temporary and permanent rock support, and the control of seepage. The secondary design problems are the roof and walls of the large openings, the main support and draft tube pillars, the powerhouse chamber, and the penstocks. Field investigations, construction procedures, and monitoring instrumentation are also presented. In conclusion, much room remains for future progress, including improving the designs for the weak rock sites. 2 refs., 4 tabs.

44112 (TAC–CE02875, pp. 251-258) **Planning and design of large underground structures for 1500 MW Nathpan Jhakri Hydroelectric project.** Char, S.A. (Central Water Commissison, New Delhi (India)); Thareja, D.V. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper is about the geophysical, lay-out and design studies of Nathpa-Hharkri, a fully underground hydroelectric project on the Satluj River, which is currently in its active planning and design stage. The project will have a rated capacity of 1,500 MW and is supported by a loan from the World Bank. The geophysical studies of the site are summarized; the rocks have a mixed lithologic and tectonic behavior and may necessitate a modification of the usual rock classification systems. The lay-out and design of the project are discussed, including the power tunnel (which crosses the Manglad Khad natural depression through a syphon), the powerhouse complex and the de-silting chambers. A number of drifts and audits excavated have provided enough geo-technical data to carry out a detailed method and the method of rock-support interaction analysis. Special problems of hazardous tunneling which are likely to be encountered, and the proposed remedial measures, are also outlined. 8 refs., 3 figs.

44113 (TAC–CE02875, pp. 365-272) **Engineering of the tail race outlet portal for the Chamera hydroelectric project, India.** Donnelly, C.R. (SNC/Acres Joint Venture, Niagara Falls, ON (Canada)); Powell, D.B.; Hansen, E.; Sharma, B.K. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper describes the design and construction, in weak shales, of a tunnel portal with only half a diameter of cover. The site conditions are presented, and the feasibility of establishing a portal with approximately half a tunnel diameter of cover is justified. The design and construction of the tunnel portal are outlined.

After completion, a detailed inspection suggested that 3-dimensional strain effects were experienced within the portal area over a period of several months. It is likely that the strain-softening mode of behaviour of the rock, which was expected at the design stage, was incompatible with that of a stiff layer of shotcrete, leading to de-bonding and yielding of the layer. However, there was no evidence, at the portal face, that any of the rock bolts had failed. Also, the pre-reinforcement of the rock was effective in controlling the deformations over the portal length, when combined with the retraining effect of the concrete slab and tunnel steel ribs. 2 years after the completion of the excavation, the portal is performing more or less satisfactorily. 1 ref., 6 figs., 1 tab.

44114 (TAC–CE02875, pp. 331-340) **Unconventional design and grouting methods used at Hylte hydro power station, Sweden.** Knutsson, B. (Sydkraft, Malmoe (Sweden)); Alestam, M.; Brunnsaeter, M. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper is about the design and construction of an inverted syphon for a hydroelectric power plant. The 26 MW capacity Hylte power station is presently under construction on the river Nissan, in southern Sweden. Its design is unconventional since the water is led via an inverted syphon from the intake at one side of the valley to the power station at the other side. When crossing the valley, the syphon passes below the village of Hyltebruk and the big paper mills which are located there. The water pressure in the syphon is approximately 25 m above the level of the ground. The rock consists of crystalline gneiss, and, under the valley there is a wide fault zone. The tunnelling and its reinforcement with steel, rock bolts and layers of reinforced shortcrete are described. During the sealing work, the water in the rock was found to be heavily polluted by salts and organic materials; cement grouts did not harden. After several tests, successful grouting work was resumed and polyurethanic foam was used. 7 figs.

44115 (TAC–CE02875, pp. 463-470) **High pressure concrete plugs for hydropower projects: Review and design and operational experiences in Norway.** Bergh-Christensen, J. (Berdal Stroemme A/S (Norway)). Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper presents some preliminary findings of a research project with the purpose of documenting and developing the know-how concerning the design, construction and operation of high-pressure concrete plugs in Norwegian high-head hydroelectrical power plants. Critical construction elements at these plants include the plugs linking the unlined conduit to the steel penstock and the access port plugs for the inspection of the tunnel system. The research project was initiated in 1988 and will be completed in 1990; its scope includes a detailed documentation of the high-pressure plugs in operation, a review of the design criteria employed in Norway and other countries, the in situ instrumentation of concrete plugs, and the finite element analysis of the stress conditions and pore pressure distribution at high-pressure plugs. Plug types and lengths, leakage, rock conditions, concrete composition and grouting are discussed. Two examples of plug design (Nyset - Steggje and Mel) are discussed in detail. Recent advances in plug design and in grouting have allowed the successful construction of concrete hydroelectrical powerplants. The developed technology might also be adapted to other projects with extreme demands, such as underground natural gas storage facilities and radioactive waste repositories. 7 refs., 8 figs., 4 tabs.

44116 (TAC–CE02875, pp. 703-710) **Tail race tunnel of Koyna Hydro Electric Project. Stage 3. Tunnelling in shear zones under the river.** Manohar, B.G. (Central Water Commission, New Delhi (India)). Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

Stages I and II of the Koyna hydro-electic project were completed in 1967 with the commissioning of the 540 MW underground power station at Pophali. Stage III, which added an installed capacity of 320 MW was completed in 1977. This article deals with the difficulties met while excavating and concreting the 4.8 km long tail race tunnel under the perennial Vaitarni river (which is the tail race of the stages I and II power-house). The tunnel had to cross thick and decayed shear zones just under the river; the problem was aggravated by the thin cover (about 10 M) between the crowning of the tunnel and the bottom of the river. The geology of the site, the scheme of the works and the excavation of the pilot tunnel are discussed. The shear zones are described; they had escaped the exploratory boreholes. The cautious working under the river, the supporting of the tunnel with steel arches, reinforced concrete and grouting, and the safety precations taken are described. It is advised that the safety precautions taken are described. It is advised that weak zones should not remain exposed for a long time after being excavated, especially if water is seeping through these zones. 4 figs.

44117 (TAC–CE02875, pp. 877-884) **Design of the surge system at the Svartisen underground hydropower scheme.** Oedegaard, L. (Norwegian State Power Board (Norway)); Johansen, L. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper describes the design of the surge system at the Svartisen Underground Hydropower project in Northern Norway. The layout of the tunnel system is both complex and non-traditional, and represents a design challenge. The surge system, which is both a water conduit and a stabilizing device, comprises a tunnel and a vertical shaft which joins the pressure tunnel only 500 m upstream of the power station. The major characteristics discussed are mass surges, stability of regulation, geological conditions and air entrainment. Regardless of the limitations imposed by the geological and topographical condition, the calculations proved that the selected surge system design was feasible when a computer-controlled turbine governor was applied. 6 refs., 4 figs.

44118 (TAC–CE02875, pp. 863-868) **Tunnelling methods and equipment at the LG-2A hydroelectric project.** Langlois, M.A. (Atlas Copco Canada Inc. (Canada)). Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper is about the public works of the LG-2A addition to the LG-2 hydroelectric power plant of the James Bay Power Corporation. The 2,000 MW LG-2A project is situated 1 km downstream from the existing 5,300MW LG-plant. The purpose of this paper is to present an overview of the methods and equipment used for the execution of LG-2A, in particular the tail-race and pen-stock, with comparisons to the methods and equipments used for LG-2. One of the most significant advances in tunneling equipment to take place during the 10 years between the 2 projects has been the introduction of mobile electric-hydraulic jumbo drills. The latest generation of such drills can at least double the performance of the

largest pneumatic drifter drills, and their relative energy consumption is much smaller; they also have reduced noise levels, a better visibility (no fog), increased hole diameter and length, better maneuverability and flexibility, and increased comfort and safety for the operator. Hydraulic tunnelling has allowed the development of versatile tunnelling equipment; smaller, more efficient drilling rigs equipped with the proper components are replacing the specially designed multi-boom units used on so many large tunnelling projects of the past. The LG-2A contractors have introduced several novelties in Canadian tunnelling: a hydraulic jumbo drill equipped with boom-elevating devices, 7.7 m hydraulic feeds, 6.1 m drifting steel, and traction-less hydraulic face shovels. 3 ref., 8 figs., 1 tab.

44119 (TAC–CE02875, pp. 911-918) **Headrace tunnel for Svartisen Hydro Power Plant, bore or blast? Choice of method.** Vinje, T. (State Power Board, Oslo (Norway)); Drake, J. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper is about the choice of tunnelling method for the headrace tunnel of the Svartisen hydroelectronic power plant in Norway, and about the results obtained so far. Basic facts are recalled about the geography of Norway and the history of the production and use of hydroelectrical power in that country. The topography and geology of the Svartisen plant site are discussed. The possible choices for the lay-out of the head-race tunnel(s) are compared, and the advantages and disadvantages of boring versus drilling, and blasting are listed. A full-face borer with a diameter of 3.5 m, nicknamed "Madam Felle", suddenly became available. The paper discusses whether the rate of progress and the cross-section of the tunnel would be sufficient and compares the costs of the two methods of tunneling. The lower cost led to the choice of boring and so far about 1500 m of tunnel have been excavated; however, the rate of penetration was about one-half of what had been expected, because only fractureless rock has been encountered so far. The rock supporting work has not been costly, even if stresses in the rock do exist since when boring starts after a period of stand-still, a better penetration rate is obtained for a few meters. Others difficulties, such as main bearing break-down, are discussed. It is projected to use tungsten carbide inserted rings on 12 of the 62 cutter positons. 3 figs., 7 tabs.

1304 Legislation and Regulations

44120 (EMR/V/CRE–CE02911, pp. 65-78) **How to apply for a water licence.** McCracken, J.W. (B.C. Ministry of Environment and Parks, Surrey, BC (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The ownership of all water in British Columbia is held by the Province. Currently only surface water is licenced. Individuals, companies or crown agencies obtain the legal right to use water by means of the water licence issued under the Water Act. This paper indicates the steps in applying for a water licence in British Columbia. The topics covered are: water law in British Columbia, the water license application process, aspects of planning a small-scale hydroelectric project, complicating factors, and general license requirements. A water license application form and a river channel description chart are provided. 4 figs.

44121 (EPRI-GS–6922) **Evaluating hydro relicensing alternatives: Impacts on power and nonpower values of water resources: Final report.** Boyd, D.W. (Decision Focus, Inc., Los Altos, CA (USA)); Nease, R.F. Jr.; Rice, J.S.; Taleb-Ibrahimi, M. Electric Power Research Inst., Palo Alto, CA (USA); Decision Focus, Inc., Los Altos, CA (USA). ©Aug 1990. 109p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The passage of the Electric consumers Protection Act of 1986 (ECPA) requires the Federal Energy Regulatory Commission (FERC) to give "equal consideration" to non-power values (e.g., energy conservation, fish, wildlife, recreation, etc.) as well as to power values in hydro relicensing. ECPA does not specify how this should be done and subsequent FERC rulemakings have not clarified the issue. In response to this situation, the Electric Power Research Institute (EPRI) initiated an effort to develop a logical methodology to address the issue of providing equal consideration to power and non-power values. The methodology presented herein evaluates hydro relicensing alternatives from a social perspective, that is, it quantifies the impact of relicensing alternatives on the total value of the water resource where the values of all those who benefit from the resource are included. The methodology was applied to three actual relicensing cases and the draft report received extensive review from the hydro industry as well as from state and federal resource agencies and recreational/environmental interest groups. 23 refs., 16 figs., 10 tabs.

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 43776, 44101, 44121, 44473

44122 (EMR/V/CRE–CE02911, pp. 83-101) **Ontario's Small Hydro Encouragement Program.** Crawford, I. (Ontario Ministry of Energy, Toronto, ON (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

The growing recognition of small hydro as a reliable economical and environmentally benign energy source, and the identification of numerous institutional and regulatory barriers to small hydro development, have led the province of Ontario in 1981, to initiate policies and programs to encourage private small hydro developments. The potential of small hydro in Ontario is summarized; though it cannot be expected to form a major fraction of the electrical power supply, it is, nevertheless, significant at the local level and as a component of capacity additions. The benefits of small hydro, the role of government, and the achievements of the encouragement program from 1981 to 1986 are discussed. As a result of the program, the nucleus of a viable small hydro industry has been established and has demonstrated its capability to design, manufacture and install small hydro systems successfully; moreover, a number of important political, legal and regulatory precedents have been established by this industry. In 1985, the existing small hydro programs and activities were re-organized into a single program. The goals and objectives of this program are summarized and its current activities (site development assistance, Northern regions and off-grid systems, industry development, technical, marketing and public information transfer, and advocacy) are presented. Since 1980, approximately 7 MW of new small hydro capacity has been commissioned in Ontario, but it is estimated that the small hydro market will continue to expand and that up to 150 MW of new small hydro generating capacity will be commissioned over the next 5 to 8 years, representing an investment of Can $475 million predominantly for Ontario produced goods and services in the export area. It is expected that Ontario's small hydro exports will increase 10 fold to Can $150 million per year over the next 5 to 10 years.

44123 (EMR/V/CRE–CE02911, pp. 49-60) **Federal perspective on small hydro development in Canada.** Pneumaticos, S.M. (Renewable Energy Branch, Energy, Mines and Resources Canada, Ottawa, ON (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical*

seminars. Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper gives an outline of the evolution of small hydroelectric power plants in Canada; it identifies the barriers that stand in the way of developing small hydro energy and outlines what is being done through the Department of Energy, Mines and Resources to overcome these barriers and accelerate the implementation of worthwhile small hydro energy projects. The evolution of small hydro power in Canada is recalled; many small hydro plants which had been incorporated into the public utility systems were decommissioned following the Second World War, but there are still more than 250 plants in Canada with the capacity of 20 MW or less, aggregating 1,250 MW. The constraints to small hydro development are discussed: economic constraints (high capital cost, difficulty of obtaining a loan, and buy-back rates), institutional constraints (bureaucracy, water rights, electricity distribution, impacts on the environment, fisheries and navigation, design standards, and existence of a surplus generating capacity in most provincial utilities), and technical constraints (essentially a re-discovery of small hydro technology). The efforts to overcome these barriers on the part of provincial goverments and utilities, the private sector, and the federal government are discussed, especially the 20 small hydro demonstration projects that have been completed since 1980 under federal cost-sharing programs,and the 19 small hydro feasibility studies that have been completed under the Remote Community Demonstration Program.

44124 (EMR/V/CRE–CE02911, pp. 325-331) **Project management & financial workshop: Discussion summary.** Millbank, N. (Novacorp Consulting Inc., Vancouver, BC (Canada)); McDonnell, G. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper comprises a brief review of the materials presented at an advanced workshop on small hydro project management and financing, and a summary of the discussions that ensued on these subjects. Project financing and financial analysis are discussed. Financial issues and concerns will change as the project moves from the planning stage, through the construction stage, to the operational stage. It is likely that external financial assistance will be critical while planning is under way, but that more financial responsibilities will be met internally as the project is developed and operations are initiated. Project management, overall management as well as detailed guidelines are dicussed. 4 stages are distinguished in the implementation of a project.

44125 (GAO/RCED–90-93) **Federal electric power views on the sale of Alaska Power Administration hyrdopower assets.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Mar 1990. 34p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report concerns the federal government's efforts to sell the assets of the Alaska Power Administration (APA) and that APA's planned divestiture approach would likely lead to a proposed sale at a price that would not provide for full cost recovery for the government or reflect the full potential value of the assets to a purchaser. Sales agreements have been reached between APA and potential purchasers of APA's assets. It was found that APA's current sale proposal does not address earlier concern about benefitting APA ratepayers at the expense of taxpayers.

1306 Environmental Aspects

Refer also to citation(s) 44101, 44121

44126 (CONF-9009164–1) **A simple empirical model of aeration at navigation dams.** Railsback, S.F. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 2. international symposium on gas transfer at water surfaces; Minneapolis, MN (USA); 11-14 Sep 1990. Order Number DE90015537. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In a study of aeration at 28 dams in the upper Ohio River basin, a least-squares linear regression model was developed to predict the dissolved oxygen deficit below the dam as a linear function of the deficit above the dam. A linear statistical model was chosen because theory-based models are not readily applicable to navigation dams and because previous empirical models do not simulate the supersaturation that field data showed. The statistical model simulates supersaturation, is an adequate predictor of aeration at almost all of the dams, and allows easy analysis of uncertainties. 8 refs., 6 figs.

14 SOLAR ENERGY

Refer also to citation(s) 44419

44127 (BFR-G–2-1989) **North sun '88 proceedings: Solar energy at high latitudes.** Broman, L.; Roennelid, M. (eds.). Swedish Council for Building Research, Stockholm (Sweden). 1989. 668p. (CONF-8808238–: North Sun '88: international conference on solar energy at high latitudes and exhibition, Borlaenge (Sweden), 29-31 Aug 1988). Source: Swedish Council for Building Research, Stockholm, Sweden.

North Sun Conferences are devoted to the utilization of solar energy and the application of solar systems at high latitudes. The Third North Sun Conference in Borlaenge, Sweden, August 29-31, 1988 attracted close to 150 delegates from 22 countries on five continents. During the 24 sessions, 89 lectures and reports were presented, all of which are included in the Proceedings. The papers are here assorted under the following headings; * Opening session with national reviews, * Large solar energy systems, * Heat storage technology, * Solar architecture for high latitudes, * Passive solar energy systems, * Solar systems for buildings, * Solar collectors: Efficiency improvements and test procedures, * Modelling of systems and components, * Materials for solar systems, * Photovoltaics, * Solar energy for industry and agriculture, * Meteorology, climatology and solar radiation measurements, * Solar energy education, * Renewable energy.

1401 Resources and Availability

Refer also to citation(s) 44484

1405 Solar Energy Conversion

Refer also to citation(s) 44148, 45327

44128 (BF-R–40.021) **Development of efficient tandem solar cells on the basis of thin polycrystalline semiconductor films. Final report.** Richter, H.; Ronge, W. Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1989. 139p. (In German). Contract BMFT 03E-8059-B. Source: Copy held by UB/TIB Hannover.

A high absorption coefficient allows the production of CdSe thin film solar cells. Low material consumption (thickness ca. 3 μm), chemical stability, and simple production technology (standard high vacuum technology) indicate the low-cost potential of the CdSe solar cell. The scope of this project was to evaluate the efficiency potential of the CdSe thin film solar cell. Two different diode konfigurations have been applied, the MIS structure and the pn heterojunction. Having achieved quite remarkable photovoltaic properties the estimated efficieny potential of 10% has not yet been reached. The best photovoltaic parameters are for the n-CdSe MIS system: 20 mA/cm^2 short current density, 700 mV open circuit voltage, 58% fill factor, and ca. 7% efficiency, and for the n-CdSe/p$^+$-ZnTe heterojunction: 850 mV open circuit voltage, short current densities around 3 mA/cm^2, and fill factors < 30%. The too low open circuit voltages are caused by an insufficient diffusion barrier. A high continuous state density distribution g(E) within the

energy gap of the polycrystalline CdSe films is suggested to be the cause. (orig.) With 61 refs., 7 tabs., 67 figs.

44129 (ENEA-RT-FARE-89-04) **Characterization, by Rutherford backscattering spectrometry, of silicon-germanium thin films.** Perillo, E.; Spadaccini, G.; Vigilante, M.; Minarini, C.; Menna, P.; Terzini, E. Naples Univ. (Italy); ENEA, Portici (Italy). Centro Ricerche Fotovoltaiche. Dec 1989. 30p. (In Italian). (RT/FARE-89-4). Order Number DE90514465. Source: NTIS (US Sales Only), PC A03/MF A01.

Hydrogenated amorphous silicon-germanium alloys, are utilized as narrow gap layers in multi-junction amorphous solar cells. Within the framework of studies on the fabrication of high conversion efficiency multi-junction amorphous silicon solar cells, a series of samples, at different Ge content, were grown by glow discharge technique, on glass and quartz substrates. The measurement of both chemical composition and the thickness of the deposited films was carried out by the Rutherford Backscattering Spectrometry (RBS) technique. Thickness measurement by mechanical and optical methods, as well as determination of composition by Electron Probe Micro Analysis (EPMA), confirm the results of the RBS analysis.

44130 (ENEA-RT-FARE-89-05) **Photovoltaic devices: Calibration techniques.** Fornarini, L.; Abenante, L.; Castello, S.; Di Francia, G.; Gentilin, L.; Zavarese, L. ENEA, Portici (Italy). Centro Ricerche Fotovoltaiche. Dec 1989. 53p. (In Italian). (RT/FARE-89-5). Order Number DE90514466. Source: NTIS (US Sales Only), PC A04/MF A01.

In view of the necessity to establish common evaluation methods for photovoltaic devices, the Technology, Growth and Employement Working Group initiated, in 1987, a second round-robin calibration of reference solar cells, mini-modules and modules. This calibration included 2 crystallyne Si solar cells, mini-modules and modules, 2 polycrystalline silicon solar cells, mini-modules and modules, 2 amorphous Si solar cells, mini-modules and modules, 1 FZ silicon solar cell and a filtered FZ silicon solar cell to match the spectral response of amorphous silicon. The laboratories involved in the calibration were: JMI(S), JRC(EEC), ENEA(I), RAE(GB), SERI(USA), PTB(FRG) and ISE(FRG). This report presents the results of the calibration and describes details of the calibration techniques used at the ENEA (Italian Commission for Alternative Energy Sources) laboratories.

44131 (ETDE-IT-90-07) **Research activities at the new Italian photovoltaic center in PORTICI (Naples), Italy.** Bianchi, G. ENEA, Casaccia (Italy). Dipt. Fonti Alternative e Risparmio Energetico. Sep 1988. 4p. (CONF-880965-26: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988). Order Number DE90514461. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 20th IEEE photovoltaic specialist conference (Las Vegas, 26-30 Sep 1988).

To contribute to the effort worldwide spent to overcome the problems still open on the solar cells technology concerning both the technical aspects and the economics, the CRIF, a research center entirely dedicated to photovoltaics, has been settled in Portici (Naples), Italy. The CRIF (Centro Ricerche Fotovoltaiche) activities will cover the whole cycle of a-Si:H solar cell technology, starting from the fabrication processes to the characterization of the materials and devices, module testing and solar cell applications. The laboratories are going to be accomodated in a building of almost 10.000 square meters. This paper reports on the lines of the ongoing research activities (at present focused on amorphous silicon and its alloys), and on the research staff.

44132 (PB-90-872391/XAB) **Solar cell materials: Silicon. January 1972-April 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for January 1972-April 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 128p. Source: NTISPC N01/MF N01.

Supersedes PB-85-871655; U.S. sales only.

This bibliography contains citations concerning the efficiency of solar cells made with silicon and silicon alloys. Amorphous cells, tandem cells, and stacked cells are considered. Silicon cell characteristics are described, and the effects of annealing, heat treatment, antireflective coatings, temperature, and grain boundaries on silicon cell efficiency are discussed. Solar cells fabricated from other materials are covered in other bibliographies. (This updated bibliography contains 304 citations, 48 of which are new entries to the previous edition.)

44133 (PIRSEM-3032) **Development of an integrated version of the SOPHOCLE generator; study of a heat pipe concentrator receiver.** Esteve, D.; Laurent, B.; Vialaret, G. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM). 1986. 30p. (In French). Order Number DE90514546. Source: NTIS (US Sales Only), PC A03/MF A01.

The heat transfer system is designed as a flattened receiver with embossed parallel aluminium faces, mounted on the lateral face of the concentrator, and curved in the inferior side where the cell is fixed. A semi-active Freon type cooling is used. First results show a radiator material gain of a factor 2.

44134 (SAND-90-2130C) **Electronic and photonic power applications.** Walko, R.J. (Sandia National Labs., Albuquerque, NM (USA)); Ashley, C.S.; Brinker, C.J.; Reed, S.T.; Renschler, C.L.; Shepodd, T.J.; Ellefson, R.E.; Gill, J.T.; Leonard, L.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009201-1: Radioluminescent technology conference, Annapolis, MD (USA), 25-26 Sep 1990). Order Number DE90015567. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Efficient conversion of radioactive decay to electrical power has been the goal of a number of past research efforts. One of these was the Elgin-Kidde nuclear battery. In this concept promethium-147 was used as a beta source which was then mixed with a phosphor to produce a radioluminescent (RL) source of light. The light source was coupled to silicon photovoltaic converters to create electricity. This photoelectric approach is being revisited using tritium based solid state compounds and advanced gas concepts to produce RL light sources being disclosed at this conference. Efficient conversion of the RL light energy to electrical energy imposes certain requirements on the semiconductor converter. These requirements will be discussed. Projections of power source electrical and physical characteristics will be presented based on reasonable design parameter assumptions. The words "Power Supply" usually evoke a vision of a rotating machine or chemical battery. However, today's technology is making increasing use of photonics, where information and even power can be moved through optical fibers. Brighter volumetric RL light sources open a whole new range of photonics-based applications, while solid state tritiated compounds provide the foundation for improved mechanical adaptability and safety. 4 refs., 6 figs., 1 tab.

44135 (SERI/TP-211-3896) **Materials analysis and device optimization of $CuInSe_2$ solar cells: Final subcontract report, 16 January 1987-15 January 1989.** Baron, B.N. (Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion); Birkmire, R.W.; McCandless, B.E.; Roy, M.; Phillips, J.E.; Shafarman, W.N. Solar Energy Research Inst., Golden, CO (USA); Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion. Jul 1990. 46p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000365. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report presents results and conclusions from the two-year research program on $CuInSe_2$ thin-film solar cells. The research was carried out in two integrated tasks: materials preparation and analysis, and high-efficiency solar cell fabrication and analysis. $CuInSe_2$ thin-films were prepared by vacuum evaporation of elemental Cu, In, and Se onto heated substrates. We present systematic studies of the effects of incident flux and substrate temperature on $CuInSe_2$ film composition and morphology. We prepared mirror smooth $CuInSe_2$ films using a newly developed aqueous bromine solution as a chemical polishing etch, and we fabricated and analyzed heterojunction photovoltaic devices with (CdZn)S, ITO/(CdZn)S, ZnO, and ZnO/(CdZn) window layer. We found the dominant recombination mechanism in high-efficiency $CuInSe_2$ devices to be space-charge recombination in the $CuInSe_2$.

We fabricated optimized one-square-centimeter $CuInSe_2$/(CdZn)S solar cells with efficiencies over 10%. 23 refs., 22 figs., 11 tabs.

44136 (SERI/TP–211-3904) **Basic studies of 3-V high efficiency cell components: Annual subcontract report, August 15, 1988–August 14, 1989.** Lundstrom, M.S. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering); Melloch, M.R.; Pierret, R.F.; Carpenter, M.S.; Chuang, H.L.; Keshavarzi, A.; Klausmeier-Brown, M.E.; Lush, G.B.; Morgan, J.M.; Stellwag, T.B. Solar Energy Research Inst., Golden, CO (USA); Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering. Jul 1990. 81p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000360. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This project's objective is to improve our fundamental understanding of the generation, recombination, and transport of carriers within III-V homo- and heterostructures. The research consists of fabricating and characterizing solar cell "building blocks" such as junctions and heterojunctions as well as basic measurements of material parameters. A significant effort is also being directed at characterizing loss mechanisms in high-quality, III-V solar cells fabricated in industrial research laboratories throughout the United States. The project's goal is to use our understanding of the device physics of high-efficiency cell components to maximize cell efficiency. A related goal is the demonstration of new cell structures fabricated by molecular beam epitaxy (MBE). The development of measurement techniques and characterization methodologies is also a project objective. We expect that the insight into III-V device physics occurring during the course of this work will help to identify paths toward higher efficiency III-V cells. This report describes our progress during the fourth year of the project. The past year's efforts centered on completing studies of heavy doping effects in p^+-GaAs and assessing the importance of similar effects in n^+-GaAs, and at continuing research on characterizing, controlling, and passivating perimeter recombination currents. We also initiated work to identify the dominant loss mechanism in $Al_{0.2}Ga_{0.8}$ As solar cells and brought on-line a new MBE growth facility and demonstrated the high-quality of the films by fabricating, with assistance from Spire Corporation, 23.8% 1-sun solar cells.

44137 (SERI/TP–211-3907) **Ion-assisted doping of 2-6 compounds during physical vapor deposition: Final subcontract report, September 1, 1985–August 30, 1989.** Bube, R.H. (Stanford Univ., CA (USA). Dept. of Materials Science and Engineering). Solar Energy Research Inst., Golden, CO (USA); Stanford Univ., CA (USA). Dept. of Materials Science and Engineering. Jul 1990. 85p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000358. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report describes a research program to (1) investigate ion-assisted doping during chemical vapor deposition of CdTe and (2) determine the influence of co-depositing ionized dopant atoms in the growth and structural and photoelectronic properties of the deposited films. In p-CdTe homo-epitaxial films, we controlled doping up to about 6×10^{16} cm^{-3} and 2×10^{17} cm_{-3} or ion-assisted depositions with As and P ions, respectively. At a growth rate of approximately 0.1 μm/min, a substrate temperature of 400°C, and ion energy of 60 eV, a maximum doping density was found near an ion current of 0.6$\mu A/cm^2$. Related studies included elucidating the role of low-energy ion damage in the ion-assisted doping process, and investigating the decrease in carrier density near the surface of p-CdTe upon heating in vacuum, H_2, or Ar. We demonstrate the ability to make carrier density profiles and to grade junctions, and we present preliminary results from polycrystalline p-CdTe films grown on graphite and alumina substrates. We also present solar cells prepared using the p-CdTe as the collector area and n-CdS as the window layer, and we examine their photovoltaic parameters for different carrier densities and configurations in p-CdTe. 91 refs., 44 figs., 5 tabs.

44138 (SERI/TP–211-3909) **High efficiency $CuInSe_2$ and $CuInGaSe_2$ cells and materials research: Final subcontract report, 1 November 1987–31 October 1989.** Gillette, R.B. (Boeing Electronics High Technology Center, Seattle, WA (USA)); Devaney, W.E.; Chen, W.S.; Stewart, J.M. Solar Energy Research Inst., Golden, CO (USA); Boeing Electronics High Technology Center, Seattle, WA (USA). Jul 1990. 60p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000362. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The results of a two year research programs are presented. A 1-cm^2 ZnO/CdZnS/$CuInGaSe^2$ solar cell with a total area efficiency of 12.5% (12.9% active area) as measured at SERI (AM1.5, 100 mW/cm^2) has been fabricated. The quantum efficiency of this device at 400 nm is over 0.7 due to the improved transmission of the ZnO/thin CdZnS window layers. The fabrication and characteristics of each of the three layers and of the complete devices are discussed. An extensive optical analysis of this cell has been done. This analysis is presented and the implications for cell performance discussed. A 4 cm^2 cell with this same structure has been fabricated with an efficiency of 11.1% (11.9% active area), again as measured at SERI. The I-V and Quantum Efficiency characteristics of this cell are presented and the reasons for the decreased conversion efficiency relative to the 1-cm^2cells are discussed. 28 refs., 24 figs., 3 tabs.

44139 (SERI/TP–211-3914) **Two terminal $CuInSe_2$ based cascade cells: Final subcontract report, 16 January 1987–15 January 1989.** Baron, B.N. (Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion); Birkmire, R.W.; McCandless, B.E.; Phillips, J.E. Solar Energy Research Inst., Golden, CO (USA); Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion. Jul 1990. 24p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE90000363. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents results and conclusions of a two-year research program on multijunction thin-film solar cells using a $CuInSe_2$ heterojunction for the low-band-gap bottom cell and either an a-Si:H (E_g = 1.8 eV) or a CdTe (E_g = 1.5 eV) heterojunction for the high-band-gap top cell in a monolithic two-terminal cascade structure. Photochemical vapor deposition was used to deposit a-Si cells. The presence of a $CuInSe_2$/(CdZn)S cell in the a-Si deposition reactor did not introduce contaminants or adversely affect the performance of conventional p-i-n cells. Procedures were developed for fabricating monolithic cascade devices with the configuration ITO/a-Si(n-i-p)/ZnO/(CdZn)S/$CuInSe_2$/Mo/glass. A prototype two-terminal a-Si/$CuInSe_2$ cascade cell had an open-circuit voltage over IV and an efficiency of 5.8%. Physical vapor deposition with extrinsic doping was studies as a preparation technique for depositing low-resistivity p-type CdTe on transparent contact materials at low temperatures. 21 refs., 8 figs., 4 tabs.

1406 Photovoltaic Power Systems

44140 (AD-A–220967/4/XAB) **Photovoltaic Array Space Power Plus diagnostics experiment.** Guidice, D.A. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1990. 6p. (FL-TR–90-0092). Source: NTIS, PC A02/MF A01.

The objective of the Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) experiment is to measure the effects of the interaction of the low- to mid-altitude space environment on the performance of a diverse set of small solar-cell arrays (planar and concentrator, representative of present and future military technologies) under differing conditions of velocity-vector orientation and simulated (by biasing) high-voltage operation. Solar arrays to be tested include Si and GaAs planar arrays and several types of GaAs concentrator arrays. Diagnostics (a Langmuir probe and a pressure gauge) and a transient pulse monitor (to measure radiated and conducted EMI during arcing) will be used to determine the impact of the environment on array operation to help various interactions models.

1407 Solar Thermal Power Systems

44141 (AFME–82.066.1) **Progress Report 1982-1985. Heliotechnology.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM).

1987. 275p. (In French). (AFME–85.91.1002.1). Order Number DE90514542. Source: NTIS (US Sales Only), PC A12/MF A01.

The different research fields of the PIRSEM program concerning solar energy, are reviewed, year by year, from 1982 to 1987: collection and concentration of solar energy, solar thermochemistry, meteorological and insolation data acquisition and analysis, THEMIS experimentation, THEK experimentation (solar power plants), etc. For each project a report is presented (objectives, conclusions, performances).

44142 (PIRSEM–3295) **Solar receiver producing a 100 bar - 550^{0}C steam with a cassette solar concentrator.** D'Utruy, B.; Blay, D.; Tuhault, J.L. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM); Poitiers Univ., 86 (France). 1987. 24p. (In French). Order Number DE90514550. Source: NTIS (US Sales Only), PC A03/MF A01.

The system is composed of a 550 degres C - 100 bar vapour boiler and a solar concentrator (concentration factor: 500). An experimental study is performed and includes: testing of the system with the CASSETTE mirror in Saint Chamas, validation of the thermal calculations with a single-tube boiler for the pre-heating, vaporization and over heating processes, study of the unsteady regimes that have to be taken into comideration when operating of a thermal engine, study of the steady regimes at 75 and 50 pc of the maximum load corresponding to different solar flux levels.

1409 Solar Thermal Utilization

Refer also to citation(s) 44149

44143 (AFME–86-91.0003.1) **Standardization of solar collectors and systems. National and international activities in CSTB in 1986.** Filloux, A.; Chevalier, J.L. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre Scientifique et Technique du Batiment, 75 - Paris (France). Jan 1987. 37p. (In French). Order Number DE90514547. Source: NTIS (US Sales Only), PC A03/MF A01.

This document reviews the work done in 1986 by CSTB in the field of standardization of solar heating equipments: standardization of a test method to evaluate the thermal performances of solar water heaters, participation to the work of ISO/TC 180 subcommittees (Terminology, materials, devices, tubes, absorbers, etc.).

44144 (AFME–222.500) **Measured performances of flat plate solar collector systems.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre Scientifique et Technique du Batiment, 75 - Paris (France). 1986. 336p. (In French). (CONF-8506292–: 5. international colloquium on plasmas and cathodic sputtering, Antibes (France), 10-14 Jun 1985). Order Number DE90514552. Source: NTIS (US Sales Only), PC A15/MF A01.

The main themes of this workshop on flat plate collector performances are: domestic hot water production (performances and operation problems), swimming pool solar heating, hot water solar production for camping grounds in the south of France and for public or residential buildings (hospitals) (actual and theoretical performance comparisons), solar heating of schools, households (direct space heating, latent heat solar space heating,...). Several examples of solar houses and buildings are described and evaluated.

44145 (ENEA-RTI-FARE–89-09) **ENEA Ispra (Italy) bioclimatic building solar chimneys. First experimental results.** Fumagalli, S.; Contadini, G.; Leonardi, G.; Ferrari, E.; Costa, E.; Soma, L. ENEA, Casaccia (Italy). Dipt. Fonti Alternative e Risparmio Energetico. 1989. 142p. (In Italian). (RT/FARE–89-9). Order Number DE90514429. Source: NTIS (US Sales Only), PC A07/MF A01.

This paper reports and comments on the experimental results obtained in a research program survey aimed at providing a design and performance technical data base characterizing the solar chimneys of the ENEA (Italian Commission for Alternative Energy Sources), demonstration bioclimatic buildings at Ispra (Italy). Mathematical models employed in the design of the solar systems are compared with compiled performance and efficiency data. From the results of this comparative analysis, a future research plan is developed.

44146 (FP–12) **Solar-heated garage/workshop: Final technical report on a Renewables-Conservation Demonstration Program Project.** Ingham, L.A. Saskatchewan Dept. of Energy and Mines, Regina, SK (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1 Mar 1983. 84p. (CE–02933). Source: Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, SK, CAN S4P 4V4. Prices: PRICES UPON REQUEST.

A combination workshop-garage of about 600 ft^2 floor area, incorporating a solar heating system, was designed and constructed in Saskatchewan as part of a demonstration project to provide data on solar heating, high insulation levels, building sealing, and related topics. Calculations were made of such factors as available solar energy, heat losses, air infiltration, and performance of vapor barriers and insulation, in order to determine the feasibility of solar heating for the building. The building system was then designed and included a high degree of thermal insulation, multiple glazed windows, and forced cooled solar collector panels on the south and east walls. Construction details are provided of the various components of the building system. Monitoring equipment including temperature recorders and an airflow meter was installed to evaluate the building's performance. Typical solar collector efficiencies were found to range from 19% for the southwest collector to 56% for the southeast collector. For a 1-month test period in February 1982, 57% of the heating load was supplied by the solar heating system and the rest by an electric backup heating system. The actual solar heat collected was 54% of that expected from theoretical calculations. This low percentage is partly due to the inability of the collectors to turn on under low radiation levels, thus reducing the overall average efficiency. Other test results are also presented for such performance indicators as air infiltration, infrared heat loss, cooldown rate, and interior humidity. 46 figs., 3 tabs.

44147 (ORNL/TM–11519) **Developing operational strategies for the Fort Benning shallow solar pond domestic water heating system: Performance testing and results.** Sharp, T.R. Oak Ridge National Lab., TN (USA). Jun 1990. 81p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90014777. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Performance tests were conducted on six of the eighty individual solar ponds that comprise the Fort Benning Shallow Solar Pond Domestic Water Heating System. The system was originally designed to operate at a 3-inch pond fill and provide 500,000 gallons of heated water daily to a laundry and barracks buildings. Since construction, hot water needs from the system have decreased approximately 50% and the original operating strategy was no longer thought to be optimum for current conditions. New operating strategies were tested that could potentially improve system performance. Specifically, these involved varying pond fill levels from 2 to 4 inches and exposure periods from 1 to 3 days. Lower pond fills were found to increase final water temperatures for all exposures. At a 1-day exposure, lowering pond fill from 3 to 2 inches increased pond performance (Btu/gal) by 30%. A larger reduction from 4 to 2 inches produced an approximate 62% increase. With hot water demand on the Fort Benning system well below capacity, lowering pond fill is an excellent option for an immediate and significant performance improvement. Although increasing exposure increased final water temperatures in all but one test case, lowering pond fill was more productive. An individual pond operating at a 3-inch fill and a 1-day exposure collects around 488 MBtu annually which is equivalent to around $4500 in avoided fuel costs. With excess capacity, only the water utilized is saving energy. Therefore, the key operating objective for Fort Benning is to add the most energy possible to the water that is used. Pond fills at Fort Benning should be reduced to 2 inches and exposures should remain at 1 day (unless more ponds are activated). This should provide an immediate increase in pond performance of approximately 30%. 5 refs., 27 figs., 4 tabs.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 44141, 44143, 44149

44148 26-percent efficient point-junction concentrator solar cells with a front metal grid. Cuevas, A. (Stanford Univ., CA (USA). Dept. of Electrical Engineering); Sinton, R.A.; Midkiff, N.E.; Swanson, R.M. *IEEE Electron Device Letters (Institute of Electrical and Electronics Engineers) (USA),* 11(1): 6-8 (Jan 1990).

This paper reports on silicon concentrator cells with point diffusions and metal contacts on both the front and back sides. The design minimizes reflection losses by forming an inverted pyramid topography on the front surface and by shaping the metal grid lines in the form of a triangular ridge. A short-circuit current density of 39.6 mA/cm^2 has been achieved even though the front grid covers 16 percent of the cell's active area of 1.56 cm^2. This, together with an open-circuit voltage of 700 mV, has led to an efficiency of 22 percent at one sun, AM1.5 global spectrum. Under direct-spectrum, 8.8-W/cm^2, concentrated light, the efficiency is 26 percent. This is the highest ever reported for a silicon cell having a front metal grid.

1420 Heat Storage

Refer also to citation(s) 44147

44149 (EUR–12158) **96 solar houses coupled to a seasonal heat store, in Groningen, The Netherlands: Demonstration project: Final report.** Paul, A. (Bredero Energy Systems, Bunnik (Netherlands)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 100p. (In English, Dutch). Sponsored by Commission of the European Communities. Contract SE 0777/83. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 8.75.

In this project the application of solar collectors for space heating and domestic hot water preheating, in a group of houses connected to a central seasonal heat store in the soil, has been investigated. The research project comprised three phases: the design, the construction and the demonstration of the solar energy installation as a whole, all within the framework of the project's objectives. In the seasonal heat storage system the surplus of energy, gained by the collectors during the summer, is stored in the upper layer of the soil. The soil itself acts as storage material. In winter the stored heat is withdrawn from the soil and used to heat the houses. Due to heat transport by conduction the seasonal heat store loses heat to the surrounding soil. Therefore, to ensure a satisfactory output, a seasonal heat store must be large. Moreover, it is also essential that a considerable group of houses is connected to such a central store. The aim of the project is to gain practical experience with the actual realization of coupling the solar houses to a large scale seasonal heat storage system and to monitor the system operation. At the current energy prices (1988), the economic feasibility of the system as a whole is practically nil. A lot of practical experience has been gained in this project both with the construction and with the operation of the system. This knowledge will certainly lead to considerable simplifications and cost reductions in future projects.

15 GEOTHERMAL ENERGY

Refer also to citation(s) 44428

44150 (FRNC-R–240) **The geothermal program. A preliminary review. A technico-economic evaluation of the low energy geothermics in France.** Lemale, J.; Pivin, M.; Decelle, O.; Ferrandes, R.; Messager, R.; Spiteri, P. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). Sep 1986. 78p. (In French). Order Number DE90514541. Source: NTIS (US Sales Only), PC A05/MF A01.

The various aspects of the french program on geothermal energy are reviewed: identification and description of the geothermal fields in France (temperature, feasibility), state of the art of the geothermal technology, resource utilization in France, description and evaluation of the different geothermal plants, analysis of the incidents, economic analysis, juridicial and institutional aspects, technological prospects.

1501 Resources and Availability

Refer also to citation(s) 44150, 44158

1502 Geology and Hydrology of Geothermal Systems

Refer also to citation(s) 44162

44151 (EUR–11290) **Community demonstration project of geothermal drilling at Saulgau.** Bertleff, B. (Landesanstalt fuer Umweltschutz Baden-Wuerttemberg, Karlsruhe (DE)); Stober, I.; Strayle, G.; Werner, J.; Eichinger, L.; Rauert, W.; Salvamoser, J.; Stichler, W.; Haenel, R.; Michel, W.; Schulz, R.; Zoth, W.; Fritz, J.; Cammerer, F.; HombergCommission of the European Communities, Luxembourg (Luxembourg). 1987. 517p. (In French). Contrat GE 67/81. Source: NTIS (US Sales Only), PC A22/MF A01.

Geothermal reservoir lies between 600 and 900 m in Karstic Jurassic limestones. It has been investigated by means of 3 geothermal wells: TB1,TB3 which is a small diameter test well and B2 which is deeper and destined to be a productive well. The trails performed on well B1 gave the following results: depth: 650 m, temperature - 42^{0}C, flowrate with 8 m drawdown - 114 m^3/h. Well B3 drilled 400 m apart from well B1, to a final depth of 928 m, completed in 9" 5/8 screens from 500 to 690 m and left as 6" 1/4 open hole from 720 to 920 m exploited the Karstic aquifer between 585 and 665 m. Reservoir characteristics are: temperature - 39^{0}C, flow rate with 28 m drawdown - 180 m^3/h. The well B2 was sunk 2.5 km distant from B3 because of interference between B2 and B3 during pumping tests. Well B2 reached the depth of 915 m and pumping tests indicated a poor production of 12.5 m^3/h at 43^{0}C. This well was obviously not adequate from the project and was abandoned. A thermal trial was performed between B1 and B3 at 20 l/s flow rate with production and injection temperature of 42^{0}C and 25^{0}C as no temperature drop was recorded in production well, the test was extended to 6 months. Dyes introduced in B3 and tritium used as tracer in B1 had been used to describe the geohydraulic flow model in the Karst. The Jurassic Karstic reservoir of the Swabian basin could be exploited by doublet with a productive capacity of 250 m^3/h and a spacing of 1500 m between production and injection wells.

44152 (LBL–26871) **Changes in thermodynamic conditions of the Ahuachapan reservoir due to production and injection.** Steingrimsson, B. (Lawrence Berkeley Lab., CA (USA)); Bodvarsson, G.S.; Cuellar, G.; Escobar, C. Lawrence Berkeley Lab., CA (USA). Jan 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890114–8: 14. workshop on geothermal reservoir engineering, Stanford, CA (USA), 24-26 Jan 1989). Order Number DE90015303. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Since large-scale exploitation of the Ahuachanpan reservoir began in 1975 with the commencement of the first 30 MW$_e$ unit, large changes in the reservoir thermodynamic condition have occurred. Drawdowns up to 15 bars have developed in the production field and significant temperature changes have been observed. In most cases temperatures have declined due to boiling in the reservoir stimulated by the pressure drawdown; cooling due to reinjection of spent geothermal fluids has also been observed. There are indications of a cold fluid recharge to the reservoir from the west and north. Increasing temperatures in the southeast corner of the wellfield show that significant recharge of hot fluids to the wellfield comes from the southeast; they also indicate that the recharge rate has increased with time as the pressure declines in the reservoir. 8 refs., 13 figs.

44153 (LBL–26872) **Modeling studies of the Ahuachapan geothermal field, El Salvador.** Aunzo, Z. (Lawrence Berkeley Lab., CA (USA)); Steingrimsson, B.; Bodvarsson, G.S.; Escobar, C.; Quintanilla, A. Lawrence Berkeley Lab., CA (USA). Jan 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890114–6: 14. workshop on geothermal reservoir engineering, Stanford, CA (USA), 24-26 Jan 1989). Order Number DE90015306. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Modeling studies of Ahuachapan include analyses of interference test data, modeling of the fieldwide pressure decline and the development of a three-dimensional natural state model of the field. The main objective of this work is to obtain reasonable estimates for the transmissivity and storativity of the reservoir and to investigate fluid and heat flow patterns in the system. The analyses of the interference test data and the long term pressure decline data indicate that the average reservoir transmissivity is about 30 Dm and the storativity about 3.5×10^{-6} m/Pa. The natural state modeling supports an overall average transmissivity of 25–35 Dm and indicates that the system is recharged with 255°C hot water at a rate of about 225 kg/s. The total thermal throughflow for the Ahuachapan system is estimated to be about 250 MW_t. 10 refs., 11 figs., 3 tabs.

44154 (LBL–28971) **Beneficial effects of groundwater entry into liquid-dominated geothermal systems.** Lippmann, M.J. (Lawrence Berkeley Lab., CA (USA)); Truesdell, A.H. Lawrence Berkeley Lab., CA (USA). Apr 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-900823–11: Annual meeting of the Geothermal Resources Council and international symposium on geothermal energy, Kailua Kona, HI (USA), 20-24 Aug 1990). Order Number DE90015726. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In all active liquid-dominated geothermal systems there is continuous circulation of mass and transfer of heat, otherwise they would slowly cool and fade away. In the natural state these systems are in dynamic equilibrium with the surrounding colder groundwater aquifers. The ascending geothermal fluids cool conductively, boil, or mix with groundwaters, and ultimately may discharge at the surface as fumaroles or hot springs. With the start of fluid production and the lowering of reservoir pressure, the natural equilibrium is disrupted and cooler groundwater tends to enter the reservoir. Improperly constructed or damaged wells, and wells located near the margins of the geothermal system, exhibit temperature reductions (and possibly scaling from mixing of chemically distinct fluids) as the cooler-water moves into the reservoir. These negative effects, especially in peripheral wells are, however, compensated by the maintenance of reservoir pressure and a reduction in reservoir boiling that might result in mineral precipitation in the formation pores and fractures. The positive effect of cold groundwater entry on the behavior of liquid-dominated system is illustrated by using simple reservoir models. The simulation results show that even though groundwater influx into the reservoir causes cooling of fluids produced from wells located near the cold-water recharge area, it also reduces pressure drawdown and boiling in the exploited zone, and sweeps the heat stored in the reservoir rocks toward production wells, thus increasing the productive life of the wells and field. 9 refs.

44155 (LBL–29046) **Interaction of cold-water aquifers with exploited reservoirs of the Cerro Prieto geothermal system.** Truesdell, A.H. (Geological Survey, Menlo Park, CA (USA)); Lippmann, M.J. Lawrence Berkeley Lab., CA (USA). Apr 1990. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-900823–12: Annual meeting of the Geothermal Resources Council and international symposium on geothermal energy, Kailua Kona, HI (USA), 20-24 Aug 1990). Order Number DE90015728. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Cerro Prieto geothermal reservoirs tend to exhibit good hydraulic communication with adjacent cool groundwater aquifers. Under natural state conditions the hot fluids mix with the surrounding colder waters along the margins of the geothermal system, or discharge to shallow levels by flowing up fault L. In response to exploitation reservoir pressures decrease, leading to changes in the fluid flow pattern in the system and to groundwater influx. The various Cerro Prieto reservoirs have responded differently to production, showing localized near-well or generalized boiling, depending on their access to cool-water recharge. Significant cooling by dilution with groundwater has only been observed in wells located near the edges of the field. In general, entry of cool water at Cerro Prieto is beneficial because it tends to maintain reservoir pressures, restrict boiling, and lengthen the life and productivity of wells. 15 refs., 10 figs., 1 tab.

44156 (PB–90-232034/XAB) **Hydrologic and geochemical monitoring in Long Valley caldera, Mono County, California, 1986. Water Resources Investigation.** Farrar, C.D.; Sorey, M.L.; Sore, S.A.; Rojstaczer, S.A.; Steinemann, A.C. Geological Survey, Sacramento, CA (USA). Water Resources Div. 1989. 80p. (USGS/WRI–89-4033). Source: NTIS, PC A05/MF A01.

Also available from Supt. of Docs.

The U.S. Geological Survey continued to monitor hydrologic and geochemical conditions in the Long Valley caldera during 1986. The monitoring is directed toward detecting changes in the hydrologic system caused by tectonic or magmatic processes. Data collected during 1986 include chemical and isotopic composition of water from selected stream sites, springs, and wells; pumpage from four geothermal wells; flow rates of selected springs and stream sites; mean daily water or gas temperatures at selected sites; mean daily atmospheric pressures and water levels at selected wells, and precipitation records for two sites. Seismicity within the caldera persisted at a relatively low level compared with the more active periods of 1978-84. The most significant events of seismicity that affected hydrologic monitoring sites in Long Valley during 1986 occurred during July, in response to the Chalfant Valley earthquakes, centered about 20 miles southeast of the caldera.

44157 (PIRSEM–0243.1) **A probabilistic and geostatistical approach of the fracture fields - Application to geothermal sites.** Thomas, A.; Pineau, A.; Blin-Lacroix, J.L.; Razack; Drogue; Grillot; Gagny; Courrioux. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM); Institut National Polytechnique, 31 - Toulouse (France). 1986. 326p. (In FR, EN). Order Number DE90514554. Source: NTIS (US Sales Only), PC A15/MF A01.

Various papers concerning the numerical modelization of geological fields are presented, and especially of fracture fields. Fractures are defined by morphological random variables and their spatial features depend on architectural regionalized variables. Different methods for the statistical analysis of the fracture spatial distribution are used and demonstrated: numerical approach for aerial views, fissuration porosity approach, determination of a spatial fracture network, structural analysis of various sites, deep geothermal site selection, etc.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 44151, 44156

44158 (DOE/ID/12612–1) **Cascade geothermal drilling/corehole N-1: Final report.** Swanberg, C.A. (Geothermal Resources International, Inc., San Mateo, CA (USA)); Combs, J.; Walkey, W.C. Geothermal Resources International, Inc., San Mateo, CA (USA). 19 Jul 1988. 56p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-85ID12612. Order Number DE90015426. Source: NTIS, PC A04/MF A01 - OSTI.

Two core holes have been completed on the flanks of Newberry Volcano, Oregon. Core hole GEO N-1 has a heat flow of 180 mWm-2 reflecting subsurface temperature sufficient for commerical exploitation of geothermally generated electricity. GEO N-3, which has a heat flow of 86 mWm-2, is less encouraging. Considerable emphasis has been placed on the "rain curtain" effect with the hope that a detailed discussion of this phenomenon at two distinct localities will lead to a better understanding of the physical processes in operation. Core hole GEO N-1 was cored to a depth of 1387 m at a site located 9.3 km south of the center of the volcano. Core hole GEO N-3 was cored to a depth of 1220 m at a site located 12.6 km north of the center of the volcano. Both core holes penetrated interbedded pyroclastic lava flows and lithic tuffs ranging in composition from basalt to rhyolite with basaltic andesite being the most common rock type. Potassium-argon age dates range up to 2 Ma. Difficult drilling conditions were encountered in both core holes at depths near the regional water table. Additionally, both core holes penetrate three distinct thermal regimes (isothermal (the rain curtain), transition, and conductive) each having its own unique features based on geophysical logs, fluid

geochemistry, age dates, and rock alteration. Smectite alteration, which seems to control the results of surface geoelectrical studies, begins in the isothermal regime close to and perhaps associated with the regional water table. 28 refs., 15 figs., 2 tabs.

1508 Geothermal Power Plants

Refer also to citation(s) 44150, 44158

1509 Geothermal Engineering

44159 (LBL–28851) **Reservoir simulation and geochemical study of Cerro Prieto I wells.** Lippmann, M.J. (Lawrence Berkeley Lab., CA (USA)); Truesdell, A.H. Lawrence Berkeley Lab., CA (USA). Mar 1990. 10p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-900115–3: 15. workshop on geothermal reservoir engineering, Stanford, CA (USA), 23-25 Jan 1990). Order Number DE90015727. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Combined reservoir simulation and geochemical data analysis are used to investigate the effects of recharge and other reservoir processes occurring in the western part of the Cerro Prieto, Mexico, geothermal field (i.e., Cerro Prieto I area). Enthalpy-based temperatures and bottomhole temperatures are calculated based on simplified models of the system, considering different reservoir boundary conditions and zones of contrasting initial temperatures and reservoir properties. By matching the computed trends with geothermometer-based temperature and enthalpy histories of producing wells, the main processes active in the western area of Cerro Prieto are identified. This part of the geothermal system is strongly influenced by nearby groundwater aquifers; cooler waters readily recharge the reservoirs. In response to exploitation, the natural influx of cold water into the shallower alpha reservoir is mainly from the west and down Fault L, while the recharge to the deeper beta reservoir in this part of the field, seems to be only lateral, from the west and possibly south. 11 refs., 12 figs.

44160 (LBL–29045) **Reservoir technology research at LBL addressing geysers issues.** Lippmann, M.J.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (USA). Apr 1990. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-9004131–7: The national energy strategy–the role of geothermal technology development, San Francisco, CA (USA), 18-20 Apr 1990). Order Number DE90015725. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Geothermal Technology Division of the Department of Energy is redirecting a significant part of its Reservoir Technology funding to study problems now being experienced at The Geysers. These include excessive pressure drawdown and associated decline in well flow rates, corrosion due to high chloride concentration in the produced steam and high concentration of noncondensible gases in some parts of the field. Lawrence Berkeley Laboratory (LBL) is addressing some of these problems through field, laboratory and theoretical studies. 11 refs., 6 figs.

1520 Geothermal Data and Theory

Refer also to citation(s) 44158

44161 (LBL–26870) **The use of Ahuachapan fluid chemistry to indicate natural state conditions and reservoir processes during exploitation.** Treusdell, A.H. (Geological Survey, Menlo Park, CA (USA)); Aunzo, Z.; Bodvarsson, G.; Alonso, J.; Campos, A. Lawrence Berkeley Lab., CA (USA). Jan 1989. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890114–9: 14. workshop on geothermal reservoir engineering, Stanford, CA (USA), 24-26 Jan 1989). Order Number DE90015718. Source: NTIS, PC A02/MF A01 - OSTI.

Chemical analyses of production fluids from Ahuachapan, El Salvador, have been used to indicate natural state reservoir fluid temperatures and chloride concentrations and reservoir processes resulting from exploitation. Geothermometer temperatures (Na–K–Ca and SiO_2) and calculated aquifer Cl for early flows show a gradient from about 265°C and 9000 ppM Cl in the western part of the well field to 235°C and 6000 ppM Cl in the eastern part. The geochemical temperatures are 10–20°C higher than early downhole measurements. Since exploitation started, pressures have declined over most of the drilled area with boiling and excess-enthalpy discharges in the eastern and western parts. In the center of the field, a number of wells show mixing with cooler, less-saline water. These wells are nearly coincident with a major NE-SW oriented fault that may be the conduit for downward recharge of cooler fluids from an overlying aquifer. 12 refs., 9 figs., 1 tab.

44162 (PIRSEM–0245) **Geothermal historical survey of sedimentary basins.** Vasseur, G.; Lucazeau, F. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM). 1986. 23p. (In French). Order Number DE90514540. Source: NTIS (US Sales Only), PC A03/MF A01.

A mathematical model of the thermal evolution of sedimentary basin is developed; one - and two - dimension algorithms are used to simulate the temperature evolution in all the lithosphere complexes (even with oceanic lithosphere intrusions). Convective transfers in porous and permeable sediments are also taken into account. Data are collected for the application of this model to actual examples (Africa).

44163 (PIRSEM–0251) **Influence of the hydrodynamical instabilities on the temperature distribution in a deep geothermal exchanger.** Caltagirone, J.P.; Gounot, J. Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM); Bordeaux-1 Univ., 33 - Talence (France). 1987. 32p. (In French). Order Number DE90514551. Source: NTIS (US Sales Only), PC A03/MF A01.

The permeability of the geothermal sites is known to be very often not unform even with homogeneous materials. A two-dimensional study of the natural connection in inhomegeneous porous medias is presented. The results show the major influence of the inhomogeneities distribution on the local temperature gradients.

16 TIDAL AND WAVE POWER

1604 Economic, Industrial, and Business Aspects

44164 (EMR/RE–M91-7/16-1988E) **Tidal power in Canada: A review.** Clark, R.H. Department of Energy, Mines and Resources, Ottawa, ON (Canada). Renewable Energy Div. May 1987. 167p. Contract EMR FPS-86-0003. (MICROLOG–89-05665). Source: PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Current estimates place the total capacity of all possible tidal electric plants at 1 million megawatt with an expected output of perhaps 3000 terawatt hours. The geography of the Bay of Fundy, where the tidal range is probably the highest in the world, promotes a concentration of tidal energy which has fostered many attempts to harness this renewable energy resource on Canada's east coast. The purposes of this report are to summarize the developments to date on tidal power activities world wide; to review recent engineering investigations of the Bay of Fundy potential; and to identify the principle technical and environmental issues still requiring resolution. The investigations of 1966-69, 1976-77, 1981-82 and 1984-85 concluded that a tidal plant in the Cumberland Basin (Site A8) could be a major regional asset with a useful life of about a century, with no fuel costs, no environmental pollution loading and reduction of energy costs over the long term. Although tidal energy could compete in the United States market with the cost of energy generated from fossil fuels, that market is not currently interested in cyclic power supply. Since the reassessment studies, the hydrodynamic mathematical models has also been improved to provide better predictions on tidal current changes, mixing proccesses and sedimentation changes. Such a model will enable detailed hydraulic model tests to be carried out for planning

of construction procedures, caisson placements and sedimentation processes. 68 refs., 18 figs., 3 tabs.

17 WIND ENERGY

1704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 44189

1706 Wind Energy Engineering

44165 (AFME–84-350-0277) **Development of a test facility for a mechanical electrical energy. Transformer connected to an aerogenerator: an experimental modelling of wind machines.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 27p. (In French). Order Number DE90514538. Source: NTIS (US Sales Only), PC A03/MF A01.

Design and development of a test facility for the testing, in steady state, of mechanical-electrical energy converter groups coupled with wind turbines. A theoretical wind turbine model is proposed. An application of this model is to drive the test facility with a micro-computer. Different ways of simulation are examined.

44166 (CONF-860433–) **Proceedings.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 233p. (In French). From International workshop on the dynamic behavior of wind turbines; Sophia Antipolis (France); 28-30 Apr 1986. Order Number DE90514553. Source: NTIS (US Sales Only), PC A11/MF A01.

The main themes of this international workshop on wind turbine dynamic behaviour are: wind influence on dynamic behaviour, influence of material fatigue behaviour, development of structural dynamic models, comparison of model and experimentation results on dynamic behaviour, development of dynamic models (gyroscopic behaviour, simulation of variable speed wind turbine), parts design in regards to their dynamic behaviour wind-diesel systems, rotors optimization, electrical generators optimization and technico-economical optimization of systems.

44167 (ETDE-IT–90-21) **Unsteady aerodynamics of windmill rotors in presence of yaw.** Arsuffi, G.; Guj, G.; Morino, L. ENEA, Casaccia (Italy). Centro Ricerche Energia; Rome Univ. (Italy). Oct 1989. 7p. (CONF-8910443–1: International symposium on boundary element methods (ISBEM), East Hartford (C is not a valid Country Code.), 2 Oct 1989). Order Number DE90514420. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the international symposium on boundary element methods (ISBEM), East Hartford, 2-4 Oct 1989.

The objective of this paper is to present a method to calculate the pressure and velocity fields of a horizontal-axis wind turbine (HAWT) in the presence of yaw. The flow is assumed to be potential and incompressible. The formulation used is general and applicable to unsteady incompressible potential flows around wind turbines, as well as aircraft and ship propellers. The main problem in the acrodynamic analysis of the HAWT is to define the wake geometry because no systematic studies (such as those for helicopter rotors) exist in this field. In the past, both numerical and experimental approaches were used to study this problem. Because of this lack of data on the wake geometry, the approaches used in the non-axial flow analysis are typically experimental. A free-wake analysis is also included.

44168 (SERI/TP–254-3799) **Comparison of wind tunnel airfoil performance data with wind turbine blade data.** Butterfield, C.P.; Scott, G.N.; Musial, W. Solar Energy Research Inst., Golden, CO (USA). Jul 1990. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-900801–24: 25. intersociety energy conversion engineering conference, Reno, NV (USA), 12-17 Aug 1990). Order Number DE90000343. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Horizontal-axis wind turbine (HAWT) performance is usually predicted by using wind tunnel airfoil performance data in a blade element momentum theory analysis. This analysis assumes that the rotating blade airfoils will perform as they do in the wind tunnel. However, when HAWT performance is measured in full-scale operation, it is common to find that peak power levels are significantly greater than those predicted. This has led to empirical corrections to the predictions. Viterna and Corrigan proposed the most popular version of this correction. But very little insight has been gained into the basic cause of this discrepancy. The Solar Energy Research Institute (SERI), funded by the US Department of Energy (DOE), has conducted the first phase of an experiment focused on understanding the basic fluid mechanics of HWAT aerodynamics. Results to date have shown that unsteady aerodynamics exist during all operating conditions and dynamic stall can exist for high yaw angle operation. Stall hysteresis occurs even for small yaw angles, and delayed stall is a very persistent reality in all operating conditions. Delayed stall is the result of a leading-edge suction peak remaining attached through angles of attack (AOAs) up to 30°. Wind tunnel results show this peak separating from the leading edge at 18° AOA. The effect of this anomaly is to raise normal force coefficients and tangent force coefficients for high AOA. Increased tangent forces will directly for high AOA. Increased tangent forces will directly affect HAWT performance in high wind speed operation. This report describes pressure distribution data resulting from both wind tunnel and HAWT tests. A method of bins is used to average the HAWT data, which are compared to the wind tunnel data. The analysis technique and the test setup for each test are described. 10 refs., 15 figs.

44169 Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. (Sandia National Labs., Albuquerque, NM (USA)). 252p. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This book contains the proceedings of the 9th ASME Wind Energy symposium. Topics covered include: wind inputs, wakes and array effects, aerodynamics, control systems and economics, and power systems and utility interface.

44170 Effects of trees on wind flow variability and turbulence. Elliot, D.L. (Pacific Northwest Lab., Richland, WA (USA)); Barnard, J.C. pp. 9-16 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper describes the results of a field experiment to examine the effects of trees on wind flow variability and turbulence. Although vegetation at the site consisted primarily of grass, scattered areas of trees that penetrated the site provided an excellent opportunity to evaluate the effects of surface roughness changes on the wind flow characteristics. Wind data collected at nine towers across the site revealed that surface roughness changes in the upwind fetch caused pronounced variations in the wind flow over site. At two towers that were frequently downwind of a grove of trees, 30% reductions in wind speed and a factor of 2 to 3 increase in turbulence were measured at heights of 32 m (approximately twice the tree height). A substantial increase in the magnitude of the wind gusts, as well as a considerable decrease in the mean wind speed, was observed when a tower was downwind of the trees. The effects of the trees on the wind flow characteristics were considerably reduced at heights of 60 m and at distances greater than 500 m.

44171 Turbulent wind at the equatorial segment of an operating Darrieus wind turbine blade. Connell, J.R. (Colorado State Univ., Fort Collins, CO (USA). Dept. of Civil Engineering); Morris, V.R. pp. 25-32 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC06-76RL01830. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

Six turbulent wind time series, measured at equally spaced equator-height locations on a circle 3 m outside a 34-m Darrieus rotor, are analyzed to approximate the wind fluctuations experienced by the rotor. The flatwise lower root-bending stress on one blade was concurrently recorded. The wind data are analyzed in

three ways: wind components that are radial and tangential to the rotation of a blade were rotationally sampled; induction and wake effects of the rotor were estimated from the six Eulerian time series; and turbulence spectra of both the measured wind and the modeled wind from the PNL theory of rotationally sampled turbulence. The wind and the rotor response are related by computing the spectral response function of the flatwise lower root-bending stress. Two bands of resonant response that surround the first and second flatwise modal frequencies shift with the rotor rotation rate.

44172 A procedure for estimating aerodynamic loads on horizontal axis wind turbines using measured bending moments. Simms, D.A. (Solar Energy Research Inst., Golden, CO (USA)); Butterfield, C.P.; Wright, A.D.; Hansen, A.C. pp. 49-50 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

Current analytical methods used to model the performance of horizontal axis wind turbines (HAWT's) typically under-predict machine power production, especially during stalled operating conditions. Power predictions based on two-dimensional wind tunnel aerodynamic data are accurate when compared to measured non-stalled operating data. However, as the machine approaches stall, predictions become erroneous. It is suspected that this is caused by three-dimensional flow effects which are not yet clearly understood. The authors explore a technique in which flapwise bending moment data and known blade properties are used to estimate deterministic mean and cyclic airloads. This technique as originally developed for use on helicopter rotors, and exists in a computer code called ALEST [air load estimating program]. They have modified the code for use on HAWT's by adding gravity, precone, and pitch angle effects.

44173 Estimated spanwise aerodynamic loads on a rotating blade. Butterfield, C.P. (Solar Energy Research Inst., Golden, CO (USA)); Simms, D.A.; Wright, A.D. pp. 51-54 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper describes a research program developed to investigate the cause of underprediction of peak power and loads by performance predictions. Spanwise variation in airfoil performance experiments and their anticipated results are addressed.

44174 A comparison of two- and three-dimensional S809 airfoil properties for rough and smooth HAWT rotor operation. Musial, W.D. (Solar Energy Research Inst., Golden, CO (USA)); Butterfield, C.P.; Jenks, M.D. pp. 63-70 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

The authors have carried out tests to measure the effects of leading-edge roughness on an S809 airfoil using a 10m, three-bladed, horizontal-axis wind turbine (HAWT). Detailed inflow measurements were taken. Particulars of the tests are offered as are comparisons between power curves, and between rough and smooth wind tunnel data.

44175 Unsteady effects on airfoil angle of attack measurements. Oler, J.W. (Texas Tech Univ., Lubbock, TX (USA)); Im, B.J.; Strickland, J.H. pp. 71-74 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

A numerical investigation has been conducted to evaluate the magnitude of the uncertainty in direct angle-of-attack measurements on a Darrieu turbine. It is shown that the unsteady induced flow effects have a significant impact on the accuracy of angle-of-attack measurements. For a tip-to-windspeed ratio of 9.6, where the angle-of-attack expected to vary between ± 6 degrees, the uncertainty of the angle-of-attack measurement is approximately ± 1 degree. At a lower tip-to-windspeed ratio of 4.4, the angle-of-attack will vary between ± 13 degrees with a measurement uncertainty of ± 3 degrees. At lower tip-to-windspeed ratios where aerodynamic stall is likely to occur, the uncertainty of the angle-of-attack measurements is significantly higher.

44176 Observations of dynamic stall phenomena on the sand 0018/50 airfoil with shear-stress-sensitive liquid crystal coatings. Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)). pp. 75-76 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper investigates the unsteady fluid physics associated with the dynamic stall process. Newly formulated liquid crystal coatings were applied to the surface of an oscillating airfoil. Advantages provided by such coatings are discussed. The author presents the experiment and its results.

44177 Inclusion of nonlinear aerodynamics in the flap code. Weber, T. (Solar Energy Research Inst., Golden, CO (USA)). pp. 77-82 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper determines the importance of nonlinear aerodynamics in the prediction of loads. The FLAP code has been modified to include the nonlinear relationships between the lift and drag coefficients with the angle of attack. The modification affects the calculation of the induced velocities and the aerodynamic loads. This requires an iterative procedure to determine the induced velocities instead of a closed form solution. A more advanced tower interference model has also been added that accounts for both upwind and downwind tower effects. Results from the modified FLAP code were compared to the linear version of the FLAP code and field test data. The modified FLAP code showed improvement in predicting deterministic blade loads, especially load harmonics, because of both the nonlinear aerodynamics and the improved tower interference model.

44178 Aerodynamic design and initial performance measurements for the Sandia 34-m diameter vertical-axis wind turbine. Berg, D.E. (Sandia National Labs., Albuquerque, NM (USA)); Klimas, P.C.; Stephenson, W.A. pp. 85-92 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

The DOE/Sandia 34-m diameter vertical- axis wind turbine (VAWT) utilizes a step-tapered, multiple- airfoil section blade. One of the airfoil sections is a natural laminar flow profile, the SAND 0018/50, designed specifically for use on VAWTs. The turbine has been fully operational for more than a year, and extensive turbine aerodynamic performance data have been obtained. This paper reviews the design and fabrication of the rotor blade, with emphasis on the SAND 0018/50 airfoil, and compares the performance measurements to date with the performance predictions. Possible sources of the discrepancies between measured and predicted performance are identified, and plans for additional aerodynamic testing on the turbine are briefly discussed.

44179 Space frame wind turbine. Watson, W.K. pp. 93-100 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

It is the author's belief that of the various types of beam, a cantilever beam is by far the poorest choice for supporting transversely acting loads such as those that the wind imposes on the blades and tower of a wind turbine, yet the structure of almost every modern horizontal axis wind turbine (HAWT) consists of a

slender beam (the tower) which cantilevers up from the earth's surface, plus two or three even thinner beams (the blades) which cantilever out from an axle at the tower's top. This paper describes how a change from the cantilever beam to an open truss - space frame structure for HAWT's could reduce turbine stress levels in response to the wind's force, and how this altered structure, in conjunction with a perimeter power takeoff system, might make possible lighter and lower cost HAWTs.

44180 The effect of loading difference for rigid and teetered hubson fatigue life. Hock, S.M. (Solar Energy Research Inst., Golden, CO (USA)); Thresher, R.W. pp. 111-112 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper presents key results from dynamic response testing of two different wind turbines in an effort to directly compare the dynamic loads and fatigue spectra and to draw some conclusions concerning fatigue damage rates. The dynamic response of Howden's 330-kW horizontal-axis wind turbine (HAWT) and the Northern Power Systems 100-kW North Wind 100 HAWT has been measured. The Howden machine incorporates a 26-m-diameter upwind, three- bladed, wood/epoxy rotor that operates at 42 rpm and is a rigid-hub design. The North Wind 100 rotor has a diameter of 17.8 m, is upwind, two-bladed, and constructed of fiberglass, and has a teetered hub. The Northern Power turbine's blades are fully pitchable, while the Howden uses pitchable blade tips. Three specific 10 minute data cases for each turbine are used for comparison.

44181 Prediction of stochastic blade loads for three-bladed, rigid-hub rotors. Wright, A.D. (Solar Energy Research Inst., Golden, CO (USA)); Weber, T.L.; Thresher, R.W.; Butterfield, C.P. pp. 113-120 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

In this paper, the Force and Loads Analysis Program (FLAP) code is used to predict turbulence- induced bending moments for the SERI Combined Experiment rotor blade and the Howden 330-kW blade. FLAP code predictions are compared to the power spectra of measured blade-bending moments. Two methods are used to generate turbulent wind inputs to FLAP. Conclusions are drawn as to the ability of the turbulence simulation models to provide accurate wind input to FLAP and to FLAP's ability to accurately simulate blade response to turbulence. Suggestions are made as to needed improvements in the theoretical model.

44182 Estimating the reliability of wind turbine blades. Veers, P.S. (Wind Energy Research Div., Sandia National Lab., Albuquerque, NM (US)). pp. 153-154 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper discusses structural reliability methods developed to treat the problems presented by the random nature of the factors that determine wind turbine structural life. Failure criteria and probability are addressed.

44183 Fatigue analysis of the Sandia 34 meter vertical axis wind turbine. Ashwill, T.D. (Wind Energy Research Div., Sandia National Lab., Albuquerque, NM (US)); Sutherland, H.J.; Veers, P.S. pp. 145-152 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

Miner's Rule is used to estimate the service lifetime of a blade of the Sandia 34-meter wind turbine. The effects on the life estimates due to changes in wind regimes, constitutive properties, stress states and operational algorithms were determined in a parametric study. The results illustrate the sensitivity level of the estimates to such changes and are presented in both graphical and tabular form.

44184 Structural response measurements and predictions for the Sandia 34 meter test bed. Ashwill, T.D. (Wind Energy Research Div., Sandia National Lab., Albuquerque, NM (US)); Veers, P.S. pp. 137-144 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

Measurements of structural response during operation of the 34-meter test bed vertical axis wind turbine are compared with analytical predictions. Measured structural data include stationary and rotating modal frequencies, cable natural frequencies, and operating stresses. These data are compared to analytical results obtained with the use of NASTRAN-based structural codes. In the case of operating stresses, analytical results with and without turbulence are compared to measured stresses. Data taken during two significant events, a high wind over-speed condition with an emergency stop and a cable resonance that couples with a tower natural frequency, are shown.

44185 Rainflow counting algorithm for the LIFE2 fatigue analysis code. Schluter, L.L. (Wind Energy Research Div., Sandia National Lab., Albuquerque, NM (US)); Sutherland, H.J. pp. 121-124 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). DOE Contract AC04-76DP00789. (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

The LIFE2 computer code is a fatigue/fracture analysis code that is specialized to the analysis of wind turbine components. The numerical formulation of the code uses a series of cycle count matrices to describe the cyclic stress states imposed upon the turbine. In this formulation, each stress cycle is counted or binsed according to the magnitude of its mean stress and alternating stress components and by the operating condition of the turbine. This paper describes a set of numerical algorithms that have been incorporated into the LIFE2 code. These algorithms determine the cycle count matrices for a turbine component using stress-time histories of the imposed stress states. Example problems are used to illustrate the use of these algorithms.

44186 Structural damping in wind turbines. Carne, T.G. (Sandia National Labs., Albuquerque, NM (USA)). pp. 163-164 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

The damping in an operating rotor consists of both the structural damping (the inherent energy dissipation in the materials or joints) and the aeroelastic damping (the energy transfer due to the aerodynamic-elastic coupling). This paper examines the structural damping. In particular, a number of blades manufactured from different materials for both vertical and horizontal axis turbines were tested to measure the damping in their various modes of vibration. Fiberglass, aluminum, wood, and graphite blades have been included in this study. The blades were supported by very soft elastic members to simulate completely free boundary conditions, thus eliminating energy dissipation caused by boundary conditions. The blade-structures were excited, using an instrumented hammer, and their responses were measured using accelerometers. From these data, frequency response functions were calculated, and the damping estimated. The damping levels for these blades in their different modes of vibration are compared and discussed.

44187 Description of SeaWest/SERI cooperative testing of 9m HAWTs in the San Gorgonio Pass. Larsen, O.Q. (ADASTRA, Pasadena, CA (US)); Smith, B. pp. 173-180 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA)

(1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper reports on loads testing of various components of Micon 108 kW HAWTs. The test program was conducted in the San Gorgonio Pass near Palm Springs, California. These tests compared performance and loads characteristics of different component retrofit designs with those of the original equipment. Four identical, side-by- side Micon 108 kW turbines were heavily instrumented for purposes of the comparative tests. The data acquisition system, based on equipment provided by SERI, is described. Initial data on turbine loads are presented, as well as evaluations of competing hardware retrofit strategies, based on the loads data. SeaWest plans for future testing are discussed, including the use of the instrumented turbines for future research.

44188 Performance predictions for an intermediate-sized VAWT based on performance of the 34m VAWT test bed. Dodd, H.M. (Wind Energy Research Div., Sandia National Lad., Albuquerque, NM (US)). pp. 205-210 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

The DOE/Sandia 34-m Vertical Axis Wind Turbine (VAWT) Test Bed is a research turbine that has been in operation for over a year. With the advanced technology components incorporated in the turbine (including airfoils, structures and variable speed operation), its performance can be used to predict next generation commercial VAWT potential. This paper begins with the predicted and measured performance results obtained from the Test Bed and applies these results to a hypothetical commercial machine of the same size. The effects of a number of parameters are included in the performance analyses. The importance of siting considerations are presented. This paper shows the relative contribution of variable speed operation to improved performance and discusses other aspects of variable speed. The predicted performance of a 34-m VAWT is compared to existing machines, with annual energy capture per unit of swept area being the primary comparative metric. Some cost of energy considerations associated with these technological advances are covered.

44189 Performance and cost projections for advanced wind turbines. Hock, S.M. (Solar Energy Research Inst., Golden, CO (USA)); Thresher, R.W.; Cohen, J.M. pp. 211-212 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper reports that wind technology and information gained from its study will be used to develop optimized, matured wind turbine technology that will be competitive over large geographic regions. The authors provide some insight into the possible configurations for some of the more promising near term design options, and the resulting improvements to performance and cost. The effects of these design changes on performance, durability, system cost, and operation and maintenance cost, are analyzed by comparing estimated COE's from matured systems and corresponding current, or baseline, designs.

44190 Wind farm effects on a utility subtransmission line in Hawaii. Carlin, P.W. (Solar Energy Research Inst., Golden, CO (USA)). pp. 243-249 of Proceedings of the ninth ASME wind energy symposium: SED-Volume 9. Berg, D.E. American Society of Mechanical Engineers, New York, NY (USA) (1990). (CONF-900102–: 13. energy-sources technology conference and exhibition, New Orleans, LA (USA), 14-18 Jan 1990).

This paper reports that an analysis of the electrical measurements taken at a wind farm on the island of Hawaii has yielded results which may be used by wind farms or utilities to provide simple, single step power factor correction for subtransmission lines. The author presents the procedure used in the experiment and its resulting conclusions.

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Refer also to citation(s) 43689, 43690, 43691, 43692, 43717, 44084, 44425, 44623, 44669, 44993, 45188, 45199

44191 (DOE/CE/27474–T1) **A methodology and handbook for including societal benefits in rates for cogeneration and small power production: A least cost approach.** Ohio Public Utilities Commission, Columbus, OH (USA); Cincinnati Gas and Electric Co., OH (USA); Battelle Columbus Div., OH (USA). Jun 1990. 100p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-87CE27474. Order Number DE90014933. Source: NTIS, PC A05/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.

This document reports on work conducted cooperatively by the Public Utilities Commission of Ohio, The Cincinnati Gas & Electric Company, and Battelle Memorial Institute. The work was funded, in part, by the US Department of Energy to promote the development of methodologies for "Least Cost Utility Planning" (LCUP). The project covered in this report was designed to develop a methodology for better incorporating the intangible or "non-economic" costs and benefits of small-scale power production into the analysis and rate-making process. In particular, the methodology includes such quantifiable and non-quantifiable factors as social, environmental, economic, and technological impacts as part of methodology for designing tariffs. The approach deals with costs and benefits from three different points of view: the utility, the private power producer, and society. All three viewpoints are integrated into a common framework that produces only overall results. The methodology attempts to identify net social cost; it does not attempt to indicate individual costs and benefits or any appropriate offsetting payment streams. The report presents novel ways of calculating the utility and small power producer benefits, and cost benefit analysis method that can capture the benefits to all parties. 12 refs., 12 figs., 3 tabs.

44192 (DOE/ET/10815–137) **An economic analysis of the optimum stoichiometry for an early commercial MHD [magnetohydrodynamics] steam combined cycle power plant.** Chapman, J.N.; Boss, W.H. Tennessee Univ., Tullahoma, TN (USA). Space Inst. May 1990. 72p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-79ET10815. (UTSI–89-07). Order Number DE90015863. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The principal system studies of the performance of Combined Cycle Magnetohydrodynamics (MHD) Topped, Steam Bottomed power plants performed in the past have all utilized two stage combustion, wherein the primary combustor is fired fuel rich and combustion is completed after the gases have exited the MHD topping cycle and been cooled in a radiant furnace. The question addressed in this study is how-fuel-rich or, alternatively, what is the optimum stoichiometry for the plant in the sense of minimizing the Cost of Electricity (COE)? Conclusions reached include: the overall plant efficiency increases monotonically for increased primary stoichiometry because the topping cycle mass flow increases and more power is generated by the topping cycle, less by the steam bottoming cycle; for each set of combustor pressure-oxygen enrichment values, there is a stoichiometry that minimizes capital cost; the primary stoichiometry that gives minimum levelized cost of electricity depends strongly upon coal cost – higher coal justifies the more efficient, more expensive plants resulting from higher stoichiometries; the feasibility of operating the plant at primary stoichiometries at or higher than the 94% considered in this study needs experimental verification of secondary combustor performance. 21 refs., 50 figs., 1 tab.

44193 (EGG-M–90263) **Enhanced tubes for electric utility steam condensers.** Webb, R.L. (Pennsylvania State Univ., University Park, PA (USA). Dept. of Mechanical Engineering); Jaber, H.; Chamra, L.; Kim, Nae-Hyun. EG and G Idaho, Inc., Idaho Falls, ID

(USA). 3 May 1990. 30p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-88ID12708. (CONF-9009230–1: EPRI condenser technology conference, Boston, MA (USA), 18 Sep 1990). Order Number DE90015412. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electric utility steam condensers typically use plain tubes made of titanium, stainless steel, or copper alloys. Approximately two-thirds of the total thermal resistance is on the water side of the plain tube. This program seeks to conceive and develop a tube geometry that has special enhancement geometries on the tube (water) side and the steam (shell) side. This "enhanced" tube geometry, will provide increased heat transfer coefficients. The enhanced tubes will allow the steam to condense at a lower temperature. The reduced condensing temperature will reduce the turbine heat rate, and increase the plant peak load capability. Water side fouling and fouling control is a very important consideration affecting the choice of the tube side enhancement. Hence, we have consciously considered fouling potential in our selection of the tube side surface geometry. Using appropriate correlations and theoretical models, we have designed condensation and water side surface geometries that will provide high performance and be cleanable using sponge ball cleaning. Commercial tube manufacturers have made the required tube geometries for test purposes. The heat transfer test program includes measurement of the condensation and water side heat transfer coefficients. Fouling tests are being run to measure the waterside fouling resistance, and to test the ability of the sponge ball cleaning system to clean the tubes. This paper describes the program work, and defines the performance improvements possible. 11 refs., 15 figs., 8 tabs.

44194 (EPRI-EL–6918) **Workshop proceedings: Static electrification in power transformers.** Electric Power Research Inst., Palo Alto, CA (USA); Public Service Electric and Gas Co., Newark, NJ (USA). ©Jul 1990. 256p. Sponsored by Electric Power Research Institute. (CONF-8911218–: Workshop on static electrification in power transformers, Princeton, NJ (USA), 15-17 Nov 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

Since 1982, static electrification is suspected to have caused insulation tracking and 10 to 40 inch flashover in a dozen or more large forced-oil-cooled power transformers in the US. Because of concern about the reliability of very important transformers, EPRI is sponsoring extensive research focused on static electrification in transformers. A workshop involving researchers, transformer manufacturers, component suppliers, utility engineers, and other experts was organized by PSE&G and EPRI to assess the results and identify needs for additional work. This report includes the prepared presentations of the participants and a summary of the discussion that took place at the workshop. Individual papers have been cataloged separately.

44195 (EPRI-EL–6920) **Development of gate turnoff thyristors: Final report.** Kao, Y.C. (Powerex Corp., Inc., Youngwood, PA (USA)). Electric Power Research Inst., Palo Alto, CA (USA); Powerex Corp., Inc., Youngwood, PA (USA). ©Jul 1990. 17p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The major objective of this project was to develop high voltage (2500–4500 volt), high current (1000 ampere) gate-turnoff devices suitable for electric utility applications such as drives, static VAR compensators, and HVDC. The project has been successfully completed. Devices in pilot line quantities with blocking voltages of 2500 and 4500 volts in both directions have demonstrated turnoff capability of 1000 amperes or higher. Other performance values, including the turn-on and turnoff times, the di/dt and dv/dt capabilities, and the tail time were found to be comparable to those of commercially available devices. Energy loss in the new equipment occurred mainly during the period after the device restored blocking capability. It was concluded that tail current flowing through the device at high voltage generates nearly all the energy loss. Thus, reducing device energy loss requires control of the tail current by reducing the minority carrier lifetime in the base region. 4 figs., 2 tabs.

44196 (EPRI-GS–6876) **Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report.** Gallaspy, D.T. (Southern Co. Services, Inc., Birmingham, AL (USA)); Johnson, T.W.; Sears, R.E. Electric Power Research Inst., Palo Alto, CA (USA); Southern Co. Services, Inc., Birmingham, AL (USA); KRW Energy Systems, Inc., Madison, PA (USA); Kellogg (M.W.) Co., Houston, TX (USA); General Electric Co., Schenectady, NY (USA). ©Jul 1990. 152p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A site-specific evaluation of an integrated-gasification-combined-cycle (IGCC) unit was conducted by Southern Company Services, Inc. (SCS) to determine the effect of such a plant would have on electricity cost, load response, and fuel flexibility on the Southern electric system (SES). The design of the Plant Wansley IGCC plant in this study was configured to utilize three oxygen-blown Kellogg Rust Westinghouse (KRW) gasifiers integrated with two General Electric (GE) MS7001F combustion turbines. The nominal 400-MW IGCC plant was based on a nonphased construction schedule, with an operational start date in the year 2007. Illinois No. 6 bituminous coal was the base coal used in the study. Alabama lignite was also investigated as a potential low-cost feedstock for the IGCC plant, but was found to be higher in cost that the Illinois No. 6 coal when shipped to the Wansley site. The performance and cost results for the nominal 400-MW plant were used in an economic assessment that compared the replacement of a 777-MW pulverized-coal-fired unit with 777-MW of IGCC capacity based on the Southern electric system's expansion plans of installing 777-MW of baseload capacity in the year 2007. The economic analysis indicated that the IGCC plant was competitive compared to a baseload pulverized-coal-fired unit. Capital costs of the IGCC unit were approximately the same as a comparably sized pulverized-coal-fired plant, but the IGCC plant had a lower production cost due to its lower heat rate. 10 refs., 34 figs., 18 tabs.

44197 (EPRI-GS–6919) **Proceedings: 1989 fuel oil utilization workshop.** Sanders, C.F. (Energy Systems Associates, Tustin, CA (USA)); McDonald, B.L.; Miller, M.N. Electric Power Research Inst., Palo Alto, CA (USA); Energy Systems Associates, Tustin, CA (USA). ©Jul 1990. 296p. Sponsored by Electric Power Research Institute. (CONF-8911217–: 1989 fuel oil utilization workshop, Clearwater Beach, FL (USA), 1-2 Nov 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A workshop to review current problems relating to fuel oil utilization by electric utilities was held in Clearwater Beach, Florida on November 1–2, 1989. The 1989 Workshop was the sixth in a series dealing primarily or in part with the utilization of fuel oils. Previous workshops were held in 1983, 1985, 1986, and 1988. The fundamental objective of the 1989 workshop was the interchange of information relating to utility fuel oil projects conducted by some of the utilities, EPRI, EPRI contractors, university research, and others. The Workshop combined formal presentations on subjects dealing primarily with problems encountered in utility boiler systems burning residual fuels as their primary fuel. Included were results from actual utility operating experiences, university research, and plant test and demonstrations. Topics included acid smut and unburned carbon reduction successes and failures, particulate emission controls on oil-fired boilers using in-oil magnetism oxide additives, evaluation of handling and combustion characteristics of Orimulsion™ in a commercial utility boiler, an actual plant test of emulsion preparation and burning, an update on the PACE fuel oil quality study, the use of combustion modeling to predict carbonaceous particulate matter emissions from oil-fired utility boilers, the development of a rapid toluene equivalence test, the status of the development of an engineering model of mixing processes in residual fuel oil storage tanks, an evaluation of low-NO_x, high efficiency oil and gas burners for retrofit to utility boilers, the design of a fuel oil gun cleaning facility, and utility fuel applications of an advanced atomizer designs. Individual projects are processed separately for the data bases.

44198 (EPRI-MD–6881-Vol.1) **Proceedings: 1989 conference on advanced computer technology for the power industry: Volume 1, Computer technologies.** Ghosh, B. (ed.).

Electric Power Research Inst., Palo Alto, CA (USA); Automation Technology, Inc., San Jose, CA (USA). ©Jul 1990. 537p. Sponsored by Electric Power Research Institute. (CONF-8912108–: Conference on advanced computer technology for the power industry, Scottsdale, AZ (USA), 4-6 Dec 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

An EPRI conference to address advanced computer technology was hosted by Arizona Public Service in Scottsdale, Arizona, December 4–6, 1989. Participants represented US and foreign utilities, major electric and computer industry vendors, R&D contractors, and consulting firms. These proceedings contain the text of the technical presentations and summaries of the panel discussions. The conference objectives were: to assess modern computer technologies and how they will affect utility operations; to share US and foreign utility experiences in developing computer-based technical products; and to discuss research conducted by EPRI in advanced computer technology on behalf of its utility members. Technical presentations addressed a broad range of computer-related topics: computer-based training; engineering workshops; hypermeida and other advanced user interfaces; networks and communications; expert systems and other decision-support methodologies; intelligent database management; supercomputing architectures and applications; real-time data processing; computerized technology and information transfer; and neural networks and other emerging technologies.

44199 (EPRI-MD–6881-Vol.2) **Proceedings: 1989 conference on advanced computer technology for the power industry: Volume 2, Computer technologies.** Ghosh, B. (ed.). Electric Power Research Inst., Palo Alto, CA (USA); Automation Technology, Inc., San Jose, CA (USA). ©Jul 1990. 422p. Sponsored by Electric Power Research Institute. (CONF-8912108–Vol.2: Conference on advanced computer technology for the power industry, Scottsdale, AZ (USA), 4-6 Dec 1989). Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

An EPRI conference to address advanced computer technology was hosted by Arizona Public Service in Scottsdale, Arizona, December 4–6, 1989. Participants represented US and foreign utilities, major electric and computer industry vendors, R&D contractors, and consulting firms. These Proceedings contain the text of the technical presentations and summaries of the panel discussions. The conference objectives were: to asses modern computer technologies and how they will effect utility operations; to share US and foreign utility experiences in developing computer-based technical products; and to discuss research conducted by EPRI in advanced computer technology on behalf of its utility members. Technical presentations addressed a broad range of computer-related topics: Computer-Based Training, Engineering Workstations, Hypermedia and Other Advanced User Interfaces, Networks and Communications, Expert Systems and Other Decision-Support Methodologies, Intelligent Database Management, Supercomputing Architectures and Applications, Real-Time Data Processing, Computerized Technology and Information Transfer, and Neural Networks and Other Emerging Technologies. In addition, two panel sessions were conducted to provide a forum for utilities to discuss past and future directions of EPRI software, and the future role of engineering workstations in utilities. The results of these two panels are summarized in this paper.

44200 (EUR–12382) **The market potential of HTR [High Temperature Reactors] modular reactors as combined heat and power plants in France: Final report.** Lefevre, J.C. (Novatome, 69 - Lyon (France). Development Dept.). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation. 1989. 70p. Sponsored by Commission of the European Communities. Contract ECI-1463-B7222-86-F. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 7.50.

The objective of the study is to evaluate the market potential of small size High Temperature Reactors (HTR) for cogeneration of heat and power in France. The reference plant considered in this evaluation is the HTR-Module concept developed by INTERATOM-KWU in the Federal Republic of Germany, having a unit capacity of 200 MWt (heat only), or 80 MWe (electricity only). Aim of the study is to determine the deployment prospects of this new energy source in the industrial, commercial, and residential sectors. Against the background of a detailed analysis of today's situation and future trends as regards national structure of energy supply and demand, reference scenarios are set up. This general information forms the basis for investigation of the HTR-Module market introduction. It is determined in a step-by-step procedure which consists in evaluating first the technical potential, then in combination with an appraisal of competitiveness the economical potential, and eventually after accounting for market factors the market potential is evaluated. 12 refs., 20 figs., 12 tabs.

44201 (MC–633G580) **Utility use of variable pressure mode with two shift operation.** Wilkinson, J.R. Monenco Consultants Ltd., Rexdale, ON (Canada). Oct 1989. 121p. (CE–03111). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Current load factors and the economics of generation mean that fossil fired units of all sizes may be required to operate at part loads for extended periods as well as two-shifting or cycling. Variable pressure operation (VPO) can offer many advantages in such circumstances, including improved heat rate, reduced stress on turbines, increased control range and shortened run-up times. The objective of the study was to provide a methodology for utilities to assess the benefits of VPO and to implement it on a particular unit. Experiences of US and Canadian utilities were derived from interviews and literature to identify possible areas of concern, which appear to be boiler pressure part temperature ramp rates, water chemistry, flame stability/furnace safety at low loads and boiler drainage limitations. The methodology for implementation involves identification of the future unit operating regime from system forecasts, followed by a preliminary assessment of unit capability from operators and manufacturers. Preliminary cost benefit analysis should also be carried out at this stage to identify possible modifications that might be acceptable. The final step involves detailed feedback of actual performance after implementation, any problems that may appear and any further recommendations of improvement. 33 refs., 3 figs., 2 tabs.

44202 (OME–90-01732, pp. 1-5, Paper 11) **Cogeneration demonstration: Union Gas Ltd. Halton Division.** Lensink, M. (Union Gas Ltd., Chatham, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Union Gas Limited recently installed a cogeneration demonstration system in its Halton Service Centre in Burlington. This paper explains why cogeneration was considered for this building; describes how the project was coordinated; and lists the equipment that was installed. A review of the expected benefits of this demonstration project is given.

44203 (ORNL/FTR–2680) **[Standards for properties of steam]: Foreign trip report, September 11, 1987–September 20, 1987.** Marshall, W.L. Oak Ridge National Lab., TN (USA). 30 Sep 1987. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016116. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report summarizes (1) the actions of the international working groups on steam and high-temperature water solutions meeting in Reading, UK, (2) my input as a formal member of both working groups in achieving, from the Executive Committee of IAPS, approval as IAPS International Guidelines for our ORNL evaluations of (i) electrical conductance of water at high temperatures and pressures and (ii) solubilities of sodium sulfate in $NaCl$–H_2SO_4—H_2O solutions (primary knowledge needed for reducing corrosion in steam generators), (3) our tour of particular pilot plant facilities of CERL related to decreasing corrosion in steam power plants, and

(4) my acquirement of knowledge of possible value in assessing aluminum oxide formation that might occur in the ORNL planned Advanced Neutron Source (ANS).

44204 (PB–90-228636/XAB) **Independent critical assessment of fuel sources for Fayette Power Project Unit Number 3.** Baughman, M.L.; Malik, K.A.; Nichols, S.P. Texas Univ., Austin, TX (USA). Center for Energy Studies. Apr 1990. 75p. Source: NTIS, PC A04/MF A01.

The report has been prepared by the Center for Energy Studies (CES) at The University of Texas at Austin and presents an independent, critical assessment of a study entitled, Report on Fuel Resources for LCRA Fayette Power Project 3 (Financo, September 15, 1989). The study found significant agreement with the financial analysis performed by Financo, but also identified areas of disagreement. CES agrees with the general methodology and analysis performed in the Financo report over the time period 1995-1999. The CES model, like the Financo model, found a $43 million savings (net present value) from the use of Western coal over the 1995-1999 time period. CES found three areas of disagreement with the Financo report.

44205 (RPC–702G606) **In-situ nondestructive inspection of high temperature bolts.** Goszczynski, J.; Mitchell, A. Research and Productivity Council, NB (Canada). Jan 1990. vp. (CE–03110). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

This report describes a study to evaluate techniques available for the in-situ inspection of turbine bolts and studs. The study was divided into three main stages; information search, laboratory evaluation and field testing. The information search consisted of a literature survey covering factors influencing stud cracking, inspection methods currently used and recently developed methods applicable to in-situ inspections. Mail surveys of utilities, to determine their experiences, and of inspection equipment manufacturers, to determine the availability of equipment for in-situ inspections, were also included. Laboratory tests were carried out using advanced ultrasonic techniques involving inspections through the stud heater hole and from the stud end, utilizing cylindrically guided ultrasonic waves. Sensitivities of these techniques were determined using studs with simulated defects and also with cracked studs removed from service. The through heater hole technique was subject to field trials at two generating stations. Draft examination and inspection procedures were prepared based on this experience. Results indicate that good sensitivities to artificial and real defects have been demonstrated by both techniques and were superior to that of the traditional longitudinal inspection technique for small transverse cracks in the lower thread region. Both techniques are capable of detecting in service cracks of greater than 4 mm depth with confidence. Defect recognition for the through heater hole technique appears to be the most positive at the present time and this technique is more likely to be more easily fully developed. 93 refs., 54 figs., 1 tab.

44206 (TSI–CE03091) **Environmental assessment documents for energy from waste facility, 440 Commissioners St., Toronto, Ontario.** TSI Trintek Systems (Ontario), Inc., Concord, ON (Canada). Mar 1988. 421p. (CE–03091). Source: PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $5.28 CAN; MF $10 CAN.

This environmental assessment document, prepared by TSI Trintek Systems (Ontario) Inc., discusses the environmental impact of an energy-from-waste steam facility proposed for a site in Toronto, Ontario. The history of the project is reviewed. The environmental assessment criteria are outlined. The various types of incinerator and gas clean-up technologies currently available are compared, and a choice is made in favor of modular controlled air technology for incineration and dry injection fabric filter for gas clean-up, because of their lesser environmental effects. The design of the facility is explained, and the process, its operation and maintenance are described. The environmental impact of the project is discussed with regards to air, land, water, noise, traffic, aesthetics, and socio-economic impacts; in each case, the environmental effects are considered in tandem with the proposed mitigative measures to provide net effects. The public information program conducted by TSI Trintek is summarized, and the preliminary governmental review of the project is presented. A list of 18 users of the energy-from-waste system in Canada is provided. An appendix includes the Environmental Protection Act submission relative to the projected facility. 15 refs.

44207 **Competitive pricing in the electric industry.** Costello, K.W. (Argonne National Laboratory, Argonne, IL (USA)); Hemphill, R.C. *Resources and Energy (Netherlands),* 12(1): 49-63 (Apr 1990).

This paper deals with pricing in an increasingly competitive electric industry in the USA. Many electric utilities face the prospect over the next several years of losing a portion of their industrial load to alternative suppliers and technologies. 'Bypass' has become a major concern for electric utilities. This paper first outlines the basic economic issues associated with bypass and the choices confronting regulators when bypass has begun, or is imminent or a real possibility. It then examines different pricing options for accommodating bypass, focusing on the major features of a flexible pricing rule based on the theory of contestable markets. This rule is designed to effect optimal bypass and thereby maximize the total economics benefits of competitive forces emerging in the electric industry. 12 refs., 1 tab., 3 figs.

2002 Waste Management

Refer also to citation(s) 43714, 43715, 44196, 44197, 44389, 44486

44208 (EPRI-GS–6860) **Full-scale demonstration of desulfurization by dry sodium injection: Final report.** Fuchs, M.R. (Radian Corp., Austin, TX (USA)); Glass, J.R.; Galloway, C.S.; Blythe, G.M.; Muzio, L.J.; Hooper, R.G. Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Austin, TX (USA); Fossil Energy Research Corp., Laguna Hills, CA (USA); NATEC, Littleton, CO (USA). ©Jul 1990. 147p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes a full-scale demonstration of the injection of dry sodium sesquicarbonate and sodium bicarbonate reagents into flue gas upstream of a fabric filter for flue gas desulfurization (FGD). The demonstration was performed at the City of Colorado Springs' R. D. Nixon plant in Fountain, Colorado. This project was separated into two distinct phases. The first phase demonstrated the ability of the dry injection system to meet the 30-day rolling average of 70% SO_2 removal as required by the New Source Performance Standards (NSPS) for low-sulfur coal-fired utility boilers. The second phase was a series of short-term parametric tests to assess the effects of plant operating variables on the FGD system SO_2 removal performance. Particulate removal and pressure drop performance of the fabric filter were also measured. 12 refs., 21 figs., 21 tabs.

44209 (PB–90-228057/XAB) **Pilot-scale evaluation of reburning for cyclone-boiler NOx control. Final report, May 1987-April 1990.** Farzan, H.; Maringo, G.J. Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Apr 1990. 190p. Source: NTIS, PC A09/MF A01.

There are currently no commercially-demonstrated combustion modification techniques for cyclone boilers which reduce NOx emissions. The emerging reburning technology offers cyclone boiler owners a promising alternative to expensive flue gas cleanup techniques for NOx emission reduction. Reburning involves the injection of a supplemental fuel (natural gas, oil, or coal) into the main furnace in order to produce locally reducing stoichiometric conditions that convert NOx produced in the main combustion zone to molecular nitrogen, thereby reducing overall NOx emissions. The report presents the encouraging pilot-scale results obtained using natural gas, fuel oil, and pulverized coal (PC) as reburning fuels. At a reburning zone stoichiometry of 0.9, 67% NOx reduction for gas and oil reburning and 57% for coal reburning were achieved. Flue gas recirculation (FGR) was introduced at the reburn burners, and improved mixing and NOx reduction. FGR was more effective with PC reburning. Carbon monoxide (CO) emissions levels were low

(less than 30 ppm) throughout the various optimum test conditions. Although the carbon content of the fly ash increased, the overall combustion efficiencies were insignificantly lower for all the reburning fuels. Furnace exit gas temperatures (FEGTs) increased by less than 50 F during reburning operation. Capital costs for reburn technology on a 200-MW cyclone-fired unit can range from about $22/kW (gas) to $41/kW (coal). Ten-year levelized incremental busbar costs were sensitive to assumed reburning fuel prices. Lower projections were 1.7 mills/kWh (coal), 2.3 mills/kWh (gas), and 3.3 mills/kWh (oil).

2005 Environmental Aspects

Refer also to citation(s) 44191, 45469, 46200

44210 (PB–90-220807/XAB) **Forecasts of future emissions as applied to the electric-utility industry. Report for May 1989-March 1990.** Jones, L.G. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Mar 1990. 63p. (EPA–600/D-90/024). Source: NTIS, PC A04/MF A01.

The paper discusses forecasts of emissions of sulfur oxides and nitrogen oxides for the electric utility industry to assess the impact of these emissions on the environment and the impacts of additional reductions that have been proposed. The U.S. EPA and the National Acid Precipitation Assessment Program (NAPAP) have each employed emission and cost projection models and have developed a set of model input assumptions for their deployment. The paper compares these alternative model input assumptions and discusses their influence on the projection results of the two primary models in use by EPA (The ICF, Inc. Coal and Electric Utility Model) and by NAPAP (the Advanced Utility Simulation Model).

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 43716, 44191, 44192, 44196, 44277, 44471

44211 (ANL/EAIS/TM–20) **Technology choice in a least-cost expansion analysis framework: Effects of gas price, planning period, and system characteristics.** Guziel, K.A.; South, D.W.; Bhatarakamol, S.; Poch, L.A. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. Apr 1990. 173p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE90014845. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The current outlook for new capacity additions by electric utilities is uncertain and tenuous. The fundamental question about the additional capacity requirements center on technology choice and the factors influencing the decision process. Instead of building capital-intensive power plants, utilities have begun relying on natural gas technologies, which permit rapid construction and deployment and low capital investment. Of concern to policymakers and utility planners are the following questions: (1) What is the impact of alternative gas price projections on technology choice? (2) What influence does the planning horizon have on technology choice? (3) How important are existing system characteristics on technology choice? (4) What effect does capital cost, when combined with other technology characteristics in a capacity expansion framework, have on technology choice? In this study Argonne National Laboratory examined the impact of these concerns on technology choices in 10 representative power pools with a dynamic optimization expansion model, the Wien Automatic System Planning Package (WASP). At least-cost expansion plan was determined for each power pool with three candidate technologies–natural gas combustion turbine technology (GT), natural gas combined-cycle technology (NGCC), and integrated gasification combined-cycle technology (IGCC)–three alternative fuel price tracks, and two planning periods (10-yr versus 30-yr optimization) between the years 1995 and 2025. The three fuel price tracks represented scenarios for low, medium, and high gas prices. Sensitivity analyses were conducted on IGCC capital cost and unserved energy costs. 21 refs., 79 figs., 21 tabs.

44212 (OME–90-01732, pp. 1-15, Paper 7) **Cogeneration market trends in the United States.** Davidson, K.G. (Gas Research Inst., Chicago, IL (USA)); Hedman, B.A.; Knable, S.A. Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The cogeneration movement has now reached most parts of the United States. In terms of total capacity, the southern United States has been the leader with more than 10,000 MW of operating or planned capacity. The need for new electric generation capacity, attractive electric buyback rates, and plentiful, cheap gas were all reasons that accounted for the good showing in this region. Inexpensive and efficient, natural gas fired, combined-cycle technology was prevalent in this region of the country. Activity in the southern and western parts in the United States has slowed considerably. This is due to a temporary over-saturation of cogeneration resulting in excess capacity, which in turn, resulted in electric utility policies designed to curb the rate of cogeneration growth. However, strong movements in the northeastern part of the United States reflect a pending need for new generation capacity in the early 1990s. The growth in cogeneration in 1986 applies to all system sizes. In 1987, there was a slight reduction in all capacity sizes with the exception of the very large (greater than 100 MW) systems. This reduction can be attributed to two factors: the implementation of less favorable tax depreciation treatment for cogenerators and the conscious attempt on the part of many electric utilities to discourage the implementation of cogeneration. Compared to accumulated capacity size distribution, the very large cogenerators represent a larger share of the activity in 1987. This is due to the opening up of new markets in the eastern and northeast parts of the U.S. and the generally negative environment that has begun to pervade many other parts of the country. In terms of number of sites, smaller cogeneration facilities have experienced rapid growth through 1986. 3 refs., 10 figs.

44213 (OME–90-01732, pp. 1-20, Paper 2) **An overview of cogeneration market opportunities.** Diener, S.G. (Steven G. Diener and Associates Ltd., Toronto, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The primary objectives of this paper are to discuss recent research on potential cogeneration markets in the industrial and building sectors, and to address the issue of how cogeneration market opportunities may be realized. The key terms relating to various types of market potential: technical, economic, financial and implementation, are defined. Market segments and case studies on which the most recent estimates of potential were based are reviewed. As a by-product of this data base, the estimated theoretical or technical limits to cogeneration in each market category are presented. The approach and results of the assessment of market opportunities are outlined. A comparison of these results with several other estimates is also provided. The roles various interested parties could play in promoting the cost-effective cogeneration development in Ontario is also discussed. 2 figs., 7 tabs.

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 44263, 44348, 44352, 45985

44214 (INIS-XN–246) **Probabilistic safety assessment in nuclear power plant management.** Holloway, N.J. (ed.). Nuclear

Energy Agency, 75 - Paris (France). Jun 1989. 114p. Order Number DE90637055. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

Probabilistic Safety Assessment (PSA) techniques have been widely used over the past few years to assist in understanding how engineered systems respond to abnormal conditions, particularly during a severe accident. The use of PSAs in the design and operation of such systems thus contributes to the safety of nuclear power plants. Probabilistic safety assessments can be maintained to provide a continuous up-to-date assessment (Living PSA), supporting the management of plant operations and modifications.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 44231, 44235, 44258, 44288, 44292, 44311, 44315, 44327, 44336, 44337, 44341, 44343, 44344, 44350, 44353, 44355, 44471

44215 (BNL–52245) **RETRAN/MINET composite code documentation.** Van Tuyle, G.J.; Rohatgi, U.S.; Aronson, A.L.; Kennett, R.J.; Mallen, A.N.; Chan, B.C. Brookhaven National Lab., Upton, NY (USA). Jun 1990. 295p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. Order Number DE90014815. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

The RETRAN/MINET Composite Code, based on RETRAN O2 MOD 4 and MINET Version 1.10, is described. The objective in developing RETRAN/MINET was to extend the degree to which complex thermal-hydraulic systems can be analyzed, while providing the capability to use detailed RETRAN modeling of the reactor and other components, where needed. The MINET Code was originally developed for the analysis of complex balance of plant (BOP) thermal-hydraulic systems and already serves that purpose in support of RAMONA-3B for BWR analyses and SSC for LMR analyses. The project was sponsored by the Empire State Electric Energy Research Corporation (ESEERCO), with computer and engineering support provided by the New York Power Authority (NYPA). A "modular" interfacing technique was utilized, in that there is very little change in the programming of either individual code, except that the MINET driver program is discarded and major sub-drivers are called from the appropriate locations within RETRAN. One new common block was added to act as a buffer between the data structures for each code. During execution, boundary conditions at the interface are exchanged via this buffer, and each code sees only the "normal" boundary conditions – although some of the user's boundary conditions are overwritten at interface boundaries. A major advantage of this approach is that the interface is very localized, which is helpful for testing and makes upgrading to newer versions of RETRAN and MINET relatively straightforward. Information regarding composite code modeling, programming and utilization is provided. Sample input and output are also included. 19 figs., 7 tabs.

44216 (EPRI-ER/NP–6928) **Development of a cyclic damage evaluation method: Final report.** Nakagawa, Y.G. (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)); Yoshizawa, H.; Umemoto, T. Electric Power Research Inst., Palo Alto, CA (USA); Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan). ©Jul 1990. 67p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

An effective method of measuring the state of fatigue damage accumulation in a pressure vessel, steel, A508, was identified by microstructural examinations. Selective angle diffraction (SAD), based on electron beam technique is utilized. SAD had been proved to be effective for detecting cumulative damage (CD) in samples cyclicly deformed at two levels of constant strain amplitudes. The objectives of this study are to validate the SAD method with a composite of cyclic strains simulating LWR plant service strains, and to transform the SAD method, which requires expert operation and data analysis of electron microscopy, to a nonexpert inspection procedure. Fatigue damage was induced in test bars under cyclic conditions intended to simulate the service conditions of a BWR feedwater nozzle. Three types (A, B, C) of cyclic strains were superimposed. B and C represent events associated with scram and normal transients, respectively. The degree of damage due to those events are insignificant, and thus used as pre-fatigue conditions. Type A damage originates from pressure tests and startup/shutdown events, and control the usage factor. One of the samples (Sample 11) was made to represent the case of probable CD (0.7%), for the plant life time (~40 years). Three other samples (12, 13, 14) represented the cases of cycle up to failure, having CD of 15, 43, and 100%, respectively. 19 figs., 3 tabs.

44217 (IAEA-TECDOC–541, pp. 179-190) **Improvements in a prototype boiling water reactor: Laguna Verde, Mexico.** Zacueta, T. (Comision Federal de Electricidad, Veracruz (Mexico)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Laguna Verde is the first nuclear power station in Mexico. It has two GE Boiling Water Reactors which will produce 654 MWe each via Mitsubishi turbine generators. At this moment we are ready to load fuel on Unit 1 and 50% complete on Unit 2 beginning electromechanical installation. The project has required 3,600 million dollars including interest rate, over 1,100 full time engineers and about 3,800 direct labour workers and additionally QA, engineering, construction, start-up and operations prepared using approximately 4,400 procedures to perform their activities. Furthermore, 54 industry branches in Mexico have been qualified by quality assurance and they have been providing equipment, components and sub components for the project. Constructing Unit 2 has given us the opportunity to realize the benefits of standardization. Once "people" become familiar with a design concept, a BWR-5 with a Mark II containment in this case, the engineering, construction and testing process improves drastically. As of this date, the average savings in man-hours required to build Unit 2 is 40.59% versus the amount needed for Unit 1. We are not making any dramatic change in the design concept of Unit 1, what we are changing in Unit 2 are our working methods and improving when it is appropriate. For instance, large bore piping, HVAC ducts and cable trays are remaining as they are in Unit 1; however, small bore piping, conduit and tubing will be routed in a different manner to reduce as much as possible the number of supports. Supports in Unit 2 will be multidisciplinary since many interferences in Unit 1 were due to an excessive number of supports which were installed on a per discipline basis. We have not achieved that point yet, but in general in control systems, instrumentation and computers there is plenty of room for improvements, by using fiber optics, multiplexers, etc. We will certainly try it. (Abstract Truncated)

44218 (NORD–1990-57) **Dependencies, human interactions and uncertainties in probabilistic safety assessment.** Hirschberg, S. (ed.) (ABB Atom AB, Vaesteraas (Sweden)). Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark). Apr 1990. 297p. Order Number DE90637065. Source: NTIS (US Sales Only), PC A13/MF A01; OSTI; INIS.

In the context of Probabilistic Safety Assessment (PSA), three areas were investigated in a 4-year Nordic programme: dependencies with special emphasis on common cause failures, human interactions and uncertainty aspects. The approach was centered around comparative analyses in form of Benchmark/Reference Studies and retrospective reviews. Weak points in available PSAs were identified and recommendations were made aiming at improving consistency of the PSAs. The sensitivity of PSA-results to basic assumptions was demonstrated and the sensitivity to data assignment and to choices of methods for analysis of selected topics was investigated. (author).

44219 (NUREG/CR–5385) **Initial assessment of the mechanisms and significance of low-temperature embrittlement of cast stainless steels in LWR systems.** Chopra, O.K. (Argonne

National Lab., IL (USA)); Sather, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Argonne National Lab., IL (USA). Aug 1990. 248p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. (ANL–89/17). Source: NTIS, PC A11/MF A01 - GPO; OSTI; INIS.

This report summarizes work performed by Argonne National Laboratory on long-term embrittlement of cast duplex stainless steels in LWR systems. Metallurgical characterization and mechanical property data from Charpy-impact, tensile, and J-R curve tests are presented for several experimental and commercial heats, as well as for reactor-aged CF-3, CF-8, and CF-8M cast stainless steels. The effects of material variables on the embrittlement of cast stainless steels are evaluated. Chemical composition and ferrite morphology strongly affect the extent and kinetics of embrittlement. In general, the low-carbon CF-3 stainless steels are the most resistant and the molybdenum-containing high-carbon CF-8M stainless steels are most susceptible to embrittlement. The microstructural and mechanical-property data are analyzed to establish the mechanisms of embrittlement. The procedure and correlations for predicting the impact strength and fracture toughness of cast components during reactor service are described. The lower bound values of impact strength and fracture toughness for low-temperature-aged cast stainless steel are defined. 39 refs., 56 figs., 8 tabs.

44220 (NUREG/CR–5591-Vol.1-No.1) **Heavy-Section Steel Irradiation Program: Semiannual progress report, October 1989–March 1990: Volume 1, No. 1.** Corwin, W.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Aug 1990. 33p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11568-Vol.1-No.1). Source: NTIS, PC A03/MF A01; OSTI; INIS.

The primary goal of the Heavy-Section Steel Irradiation Program is to provide a thorough, quantitative assessment of the effects of neutron irradiation on the material behavior (particularly the fracture toughness properties) of typical pressure-vessel steels as they relate to light-water-reactor pressure-vessel integrity. The program includes direct continuation of irradiation studies previously conducted by the Heavy-Section Steel Technology Program augmented by enhanced examinations of the accompanying microstructural changes. Effects of specimen size; material chemistry; product form and microstructure; irradiation fluence, flux, temperature, and spectrum; and postirradiation annealing are examined on a wide range of fracture properties. Detailed statistical analyses of the fracture data on K_{Ic} shift of high-copper welds were performed. Analysis of the first phase of irradiated crack-arrest testing on high-copper welds was completed. Final analysis and publication of the results of the second phase of the irradiation studies on stainless steel weld-overlay cladding were completed. Determinations were made of the variations in chemistry and unirradiated RT_{NDT} of low upper-shelf weld metal from the Midland reactor. Final analyses were performed on the Charpy impact and tensile data from the Second and Third Irradiation series on low upper-shelf welds, and the report on the series was drafted. A detailed survey of existing data on microstructural models and data bases of irradiation damage was performed, and initial development of a reaction-rate-based model was completed. 40 refs., 7 figs., 4 tabs.

44221 (SKB-TR–90-07) **Examination of reaction products on the surface of UO_2 fuel exposed to reactor coolant water during power operation.** Forsyth, R.S. (Studsvik Nuclear, Nykoeping (Sweden)); Jonsson, T.; Mattsson, O. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden); Studsvik Nuclear, Nykoeping (Sweden). Mar 1990. 23p. (STUDSVIK-NF-P–89-35). Order Number DE90637066. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A limited experimental programme has been performed to examine the reaction products on the surfaces of fuel fragments from a BWR fuel rod which had operated in the defective condition for about 100 days. A yellow crust which was observed mainly on the fuel surfaces directly exposed to the reactor coolant water was identified by XRD as the sub-monohydrate of schoepite, the same material which had been found previously in spent fuel corrosion tests in deionized water. Other corrosion products with varying morphology and size, also probably UO_3 hydrate(s), were observed on surfaces some distance from the position of clad fracture. (authors).

44222 (STUDSVIK-NF(P)–89-34) **Investigation of fuel behaviour at different power levels: Final report.** Lysell, Gunnar. Studsvik Nuclear, Nykoeping (Sweden). 11 Sep 1989. 32p. Order Number DE90637067. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An experiment where a fuel rod was slowly ramped, 'bumped', up to 43 kW/m was analysed by noise analysis during the irradiation to investigate the fuel heat transfer and elongation time constant. Immediately after the irradiation the rod was examined by several PIE methods among them gamma measurements anabling the quantitative measurement of short-lived isotopes such as I-131, Te-132 and Xe-133 on both fuel and cladding specimens. These measurements indicated that a surplus of iodine over cesium could reach the cladding at pellet interfaces in a ramp situation. The gamma measurements on the fuel were also compared to EPMA analyses of Xe, Nd and Cs. Fuel microstructural data were gathered as a function of fuel radius at two different power levels on the bumped rod. The results were compared with the measured local release of Xe. (author).

44223 (STUDSVIK-NF(R)–89-83) **Failure development in leaking LWR fuel rods - a literature survey.** Pickman, D.O. Studsvik Nuclear, Nykoeping (Sweden). 1989. 144p. Order Number DE90637068. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

This review of failure development is based largely on a literature survey up by some personal interpretation and judgement where conflicting evidence appears to exist. A brief review of known causes of defects in LWR fuel rods is included. Primary defects in fuel rods may not be single, isolated, leak sites, PCI defects being a classical example where very many penetrating cracks can form in a single fuel rod. The only secondary defect mechanism is internal hydriding, although knock-on events can follow on the same, or neighbouring rods, from defects that cause and interference with local coolant flow. The major part of this survey comprises information on leak rates from typical defects, causes and rates of development of primary leak sites, meachanisms and rates of development of secondary hydride defects and analysis of activity release measurements in an attempt to characterise the number and severity of defects present.

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Refer also to citation(s) 44215, 44218, 44219, 44220, 44223, 44243, 44258, 44288, 44297, 44311, 44325, 44334, 44335, 44336, 44338, 44341, 44344, 44350, 44351, 44353, 44355, 44356, 44361, 44655

44224 (CEGB-TD/B–6259/R89) **Iodide volatility under condition relevant to PWR steam generator faults.** Gwyther, J.R.; Thornton, E.W.; Turner, D.J.; Walton, G.N. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. May 1989. 52p. (PWR/CWG/P–(89)660). Order Number DE90637072. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The evaluation of iodine volatility during steam generator tube rupture (SGTR) is hampered by three factors: (i) lack of suitable plant data under fault conditions, (ii) lack of experimental data (mainly due to the difficulty of performing experiments under the conditions required) and (iii) uncertainty in theoretical methods to extrapolate experimental data to the required conditions. This report summarises methods of estimating the volatility of hydrogen iodide and iodide salts at the required conditions of temperature and pressure. A thermodynamic method has been used to estimate HI volatility and the density correlation method for iodide salt volatility. It is assumed throughout that it is more conservative to predict higher volatility. Consideration is given to two explanations of experiments carried out at Oak Ridge National Laboratory (ORNL) on the influence of boric acid concentration and pH on the volatility of radioiodine ostensibly under SGTR conditions: (i) the

results have been interpreted in terms of reactions involving volatility of iodide salt/ion-pairs and complexation by boric acid in the gas phase and (ii) the possibility is explored that the observed results are due to the influence of oxidation leading to the formation of much more volatile iodine species. (author).

44225 (EPRI-NP–6958) **Investigation of mechanisms of environmentally accelerated crack growth in reactor pressure vessel steels: Final report.** Kobayashi, T. (SRI International, Menlo Park, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA); SRI International, Menlo Park, CA (USA). ©Aug 1990. 70p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The fracture surface topography analysis (FRASTA) technique was applied to several pressure vessel steels tested under simulated PWR service conditions in attempting to establish the mechanism underlying environmentally accelerated cyclic crack growth. FRASTA, which seeks to reconstruct the crack propagation process in microscopic detail by comparing the topographies of conjugate fracture surfaces, showed differences in the process zone microfeatures in A533B-1 and A508-2 steel and also differences in A508-2 tested in a dry argon environment. Conclusions from these observations in terms of the slip dissolution and hydrogen embrittlement crack propagation mechanisms must await further FRASTA studies aimed at clarifying the effects of the test environment and the post-test cleaning solution on the fracture surface topography. Constant extension rate tests performed in simulated PWR environments containing purposefully high sulfur concentrations resulted in no stress corrosion cracking. These results do not support the hypothesis that sulfur in the environment promotes crack propagation. 14 refs., 26 figs., 3 tabs.

44226 (ETDE-IT–90-44) **Implementation and testing of an automated in-service inspection system for the CIRENE reactor power channel.** Martinelli, R.; Vercelli, A.; Lombardi, L. ENEA, Rome (Italy). Sep 1989. 6p. (CONF-890932–1: International meeting on power stations, Liege (Belgium), 25-29 Sep 1989). Order Number DE90514519. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 10th international conference on power stations (Liege, 25-29 Sep 1989).

The paper briefly describes components, functions and capabilities of CRISIS, an integrated automatic system for inspection and gauging measurements in the power channels of CIRENE, a prototype plant designed to be a small power station hosting a 40 MW(e) heavy water/light water pressure tube natural uranium reactor. System implementation mainly consisted in the integration of CIGAR (a customized version of the in-channel inspection instrumentation for CANDU reactors, developed by Ontario Hydro), with a suitable drive and control system designed and manufactured in Italy. The latter was a retrofit, as no provisions existed in the original plant design to accomodate specific hardware for channel inspection in the reactor vault.System testing description is mainly concentrated on the demonstration of the accuracy of the ultrasonic and eddy current instrumentation packages. This was done for the estimate of two critical quantities for pressure boundary integrity in CIRENE, i.e., depth of fretting corrosion defects and thickness of the annular gap between the pressure and calandria tubes.

44227 (IAEA-TECDOC–541, pp. 145-154) **Realization of the 'inherent safety' principles in the AST-500 and AST-300 reactor designs.** Ivanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The principal decisions ensuring the AST-500 and AST-300 reactor plants safety due to inherent safety features, based on gravity and thermodynamics laws with construction of the safety systems in terms of passive means application without any energy sources and mechanisms are considered. (author). 3 refs, 4 figs, 1 tab.

44228 (IAEA-TECDOC–541, pp. 175-177) **Design requirements for APWR in China.** Zhang, F.L. (Southwest Center for Reactor Engineering Research and Design, Chengdu (China)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Prospects of the introduction, development and the required conditions of APWR have been described in this paper. It is expected that by the year 2000 and 2015 the installed nuclear capacity in China will reach to 6 GWe and 30 GWe respectively. Problems faced by China for the development of nuclear generation are discussed such as uncertainty of plans, key techniques which are not yet mastered, higher construction cost etc. The technology of APWR must be highly credible and trusted by the investors and regulations for their introduction in China. Fundamental philosophies and design requirements for the development of APWR in China are also discussed such as safety (core melt frequency = $1x10^{-6}$/reactor year), simplicity, increase in design margins, increase in plant availability and reliability, reduction in plant capital cost, increase in plant lifetime up to 60 years etc. (author).

44229 (IAEA-TECDOC–541, pp. 191-201) **Incentives for advanced concepts in France.** Boher, B. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Paris-La-Defense (France)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Through the very important nuclear program (PWRs) that France set up to cope with the electricity demand in the 1970's, and the continuous effort to improve the nuclear plants, the development of advanced concepts is explained. Some examples of the great diversity of French advanced technologies are shown. Most of them will be applied in the last French model, as also the French safety approach which is described here. This last model (called the N4 model) is presently in the erection phase at CHOOZ, and will be in operation in a few years (expected for 1991). These advanced concepts could be integrated in a nuclear power plant able to fulfill the needs of the developing countries for the 1990's, with the guarantees of proven technology which explains the success of the French Program. (author). 3 figs, 3 tabs.

44230 (JAERI-M–90-043) **DNBR analyses under steady-state and accident conditions for a double-flat-core high conversion light water reactor.** Iwamura, Takamichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Suemura, Takayuki; Okubo, Tsutomu; Hiraga, Fujio; Murao, Yoshio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 76p. (In Japanese). Order Number DE90513757. Source: NTIS (US Sales Only), PC A05/MF A01.

A double-flat-core high conversion light water reactor (HCLWR-JDF1) has been developed at JAERI aiming at better fuel utilization and higher safety margin. The HCLWR has two pancake type cores piled up with lower, internal and upper axial blankets. Fuel rods are arranged in a triangular lattice with p/d = 1.23. The lengths of each core part and each blanket part are 60 cm and 30 cm, respectively. Departure from nucleate boiling (DNB) analyses were performed under steady-state operational condition and accident conditions. The primary coolant pump trip accident and locked

rotor accident were selected for the transient analyses. The primary system transient calculations under accident conditions were performed with a best-estimate code J-TRAC using the same conservative assumptions as in the licensing calculation for a current LWR. The KfK critical heat flux (CHF) correlation coupled with the COBRA-IV-I subchannel analysis was used to evaluate the DNB ratio (DNBR). The KfK correlation was verified with the data from small scale (4 and 7 rods) CHF experiments at JAERI and 20-rods CHF experiments at Bettis Atomic Power Laboratory. The mixing coefficient and grid spacer loss coefficient used in the subchannel analyses were experimentally determined. Based on the criterion that no fuel rod in the core experiences DNB with 95 % probability at 95 % confidence level, which is used in the current LWR licensing procedure, the minimum DNBR was determined to be 1.28 with the KfK correlation. The estimated minimum DNBR's were 1.66 for the steady-state condition, 1.56 for the pump trip accident and 1.34 for the locked rotor accident. These minimum DNBR's are larger than the minimum allowable DNBR limit. The results indicate that the present HCLWR design is acceptable from a view point of the DNBR criterion. (author).

44231 (JAERI-M–90-044) **Critical heat flux experiments for high conversion light water reactor, (3): Heated length: 0.5approx1.0 m, P/D: 1.126approx1.2, number of rods: 4approx7.** Iwamura, Takamichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Okubo, Tsutomu; Suemura, Takayuki; Hiraga, Fujio; Murao, Yoshio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 164p. (In Japanese). Order Number DE90513758. Source: NTIS (US Sales Only), PC A08/MF A01.

As a part of the thermal-hydraulic feasibility study of a high conversion light water reactor (HCLWR), critical heat flux (CHF) experiments were performed using triangular array rod bundles under steady-state and flow reduction transient conditions. The geometries of test sections were: rod outer diameter 9.5 mm, number of rods 4≈7, heated length 0.5≈1.0 m, and pitch to diameter ratio (P/D) 1.126≈1.2. The simulated fuel rod was a stainless steel tube and uniformly heated electrically with direct current. In the steady-state tests, pressures ranged: 1.0≈3.9 Mpa, mass velocities: 460≈4270 kg/s·m^2, and exit qualities: 0.02≈0.35. In the transient tests, the times to CHF detection ranged from 0.5 to 25.4 s. The steady-state CHF's for the 4-rod test sections were higher than those for the 7-rod test sections with respect to the bundle averaged flow conditions. The measured CHF's increased with decreasing the heated length and decreased with decreasing the P/D. Based on the local flow conditions obtained with the subchannel analysis code COBRA-IV-I, KfK correlation agreed with the CHF data within 20 %, while WSC-2, EPRI-B and W, EPRI-Columbia and Kattor correlations failed to give satisfactory agreements. Under flow reduction rates less than 6 %/s, no significant difference in the onset conditions of DNB (departure from nucleate boiling) was recognized between the steady-state and transient conditions. At flow reduction rates higher than 6 %/s, on the other hand, the DNB occurred earlier than the DNB time predicted with the steady-state experiments. (author).

44232 (JAERI-M–90-047) **Safety analysis of double-flat-core high conversion light water reactor: Large break LOCA and station blackout ATWS.** Suemura, Takayuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iwamura, Takamichi; Okubo, Tsutomu; Hiraga, Fujio; Murao, Yoshio. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 41p. (In Japanese). Order Number DE90513795. Source: NTIS (US Sales Only), PC A03/MF A01.

A double-flat-core high conversion light water reactor (HCLWR) has been proposed by JAERI. This reactor design gives good void fraction reactivity-coefficient in spite of its tight lattice core design. And it is also sufficiently economical. Safety analyses were performed in order to examine the thermal-hydraulic acceptability of this reactor design. Two major accidents, the large break loss of coolant accident (LOCA) and the anticipated transient without scram (ATWS) initiated by the station blackout, were selected for the analyses. These accidents give most severe results and require the large minus value of void fraction reactivity-coefficient. Analyses were performed by using the best estimate code J-TRAC. The peak clad temperature (PCT) during the large break LOCA was 899degC. And maximum pressure at the pressurizer during the station blackout ATWS was 18.7 MPa. These values are lower than the limit values which are used in the current PWR licensing (1200degC and 20.6 MPa, respectively). Therefore, the present design is acceptable from a view point of reactor safety. (author).

44233 (ND-R–1173(S)(pt.9)) **The MERLIN programme: Pt. 9: Post test examination of MERLIN Bundle B.** Worswick, D.; Clifford, B.R.; Rambridge, T. UKAEA Northern Research Labs., Springfields (UK). Mar 1990. 66p. Order Number DE90637080. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The MERLIN rig is intended to investigate the deformation behaviour of Zircaloy fuel rod cladding under conditions approximating those of a large break LOCA. A preliminary series of experiments (the MERLIN Bundle B programme) has been carried out, with the aim of characterising the rig. This series of experiments concluded with a burst test, during which the cladding of a number of fuel rod simulators distended and burst. This Report describes the post test examination of the Bundle. (author).

44234 (NUREG/CR–5552) **An overview of the low-upper-shelf toughness safety margin issue.** Merkle, J.G. (Oak Ridge National Lab., TN (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Oak Ridge National Lab., TN (USA). Aug 1990. 41p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11314). Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

The low-upper-self (LUS) toughness issue has a long history, beginning with the choice of materials for the submerged arc welding process, but also potentially involving the use of A302-B plate. Criteria for vessels containing LUS materials have usually been expressed in terms of the Charpy upper-shelf impact energy. Although these criteria have had several different bases, the range of limiting values for wall thicknesses approaching 229 mm (9 in.) has remained between 54 to 68 J (40 to 50 ft-lb). Values for vessels with thinner walls and/or only circumferential LUS welds could be less. A decision on criteria to be incorporated into the American Society of Mechanical Engineers Boiler and Pressure Vessel Code is approaching. Choices to be made concern the method for estimating the decrease in upper-shelf impact energy, flaw geometry for circumferential welds, statistical significance of toughness values, the choice between J_D and J_M, reference pressure, safety factors, and the inclusion of instability pressure calculations by means of R-curve extrapolation. Nuclear Regulatory Commission research programs have been and are contributing significantly to the resolution of the LUS issue. These programs embrace all aspects of the issue, including material characterization, large-scale testing, analysis, and criteria development. This report presents a comprehensive overview of the issue, including history and recommendations for expediting its resolution. 69 refs., 16 figs., 2 tabs.

44235 (SAND–90-0114C) **Results and insights from the N Reactor Level II/III PRA [probabilistic risk assessment] for application to advanced reactor designs.** Wyss, G.D.; Kunsman, D.M.; Camp, A.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. (CONF-900917–13: American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities, Boise, ID (USA), 30 Sep - 3 oct 1990). Order Number DE90015140. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A Level II/III probabilistic risk assessment has been performed for N Reactor, a US Department of Energy production reactor. State-of-the-art methodology was employed based on methods developed by Sandia for the US Nuclear Regulatory Commission for the NUREG-1150 study. Latin Hypercube sampling techniques were used to develop uncertainty distributions for the risks associated with postulated core damage events initiated by fire, seismic and internal events as well as the overall combined risk. The results show the risks from N Reactor to be small. Systematic, procedural and phenomenological insights and their significance to future reactor designs are discussed. A key insight is that active systems can inadvertently interfere with passive systems unless proper design precautions are taken. 7 refs., 2 tabs.

44236 (SKB-TR--90-04) **Examination of the surface deposit on an irradiated PWR fuel specimen subjected to corrosion in deionized water.** Forsyth, R.S. (Studsvik Nuclear, Nykoeping (Sweden)); Eklund, U.B.; Mattsson, O.; Schrire, D. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden); Studsvik Nuclear, Nykoeping (Sweden). Mar 1990. 31p. (STUDSVIK-NF-P--88-32). Order Number DE90637081. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A yellow deposit was observed to form on the surface of a spent PWR fuel specimen exposed to corrosion in deionized water. In a parallel experiment with only groundwater leachant, no such deposits was observed. The extent and thickness of the deposit appeared to increase over a period of 5 months of air storage. Subsequent examination, including XRD analysis, showed that the deposit consisted of dehydrated schoepite, $UO_3.0.8H_2O$. (authors).

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 44200, 44258, 44264, 44265, 44269, 44275, 44276, 44316, 44317, 44358, 44359, 44991, 45257, 45325

44237 (GAO/RCED--89-206) **Better information needed for selection of new production reactor: Nuclear science.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 41p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses an August 1989 report to Congress in which the Department of Energy described its preferred strategy for constructing new production reactors for nuclear weapons materials. The report recommended urgent construction of a heavy-water reactor at the Savannah River Site and a modular high- temperature, gas-cooled reactor at the Idaho National Engineering Laboratory. The estimated cost of the two reactors is $6.8 billion.

44238 (IAEA-TECDOC--541, pp. 227-239) **The high temperature reactor as a technology for developing countries.** Baust, E. (Hochtemperatur-Reaktorbau GmbH, Mannheim (Germany, F.R.)); Sarlos, G. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

World population is growing rapidly, 80 million per year. From 5 billion in 1987 to 11 billion beyond the middle of the next century. Most of this growth is taking place in developing countries. Growth of world population increases energy demand until the year 2000 and afterwards. At the same time, ecological stresses on our environment must be limited. The HTR 500, a power plant for electricity generation with the possibility to extract process steam and district heat, is an important step on the way to commercialization for the high-temperature reactor and is a well-suited answer to all challenges, as it can supply energy under conditions acceptable to the environment and to mankind. It meets the modified demand of the power plant market, which for reasons of grid size, scope of financing and the lower increase in electricity demand internationally, shows a trend towards power units in the size range of 300 to 600 MW. Electricity growth rates in industrialized countries are lower after the oil price escalations, and in developing countries grid sizes are often too small for the operation of large LWRs. This indicates a potential for medium-sized power reactors such as the HTR 500. Due to the use of HTR-specific characteristics and extensive application of the technology of the THTR 300 reference plant, the HTR 500 can compete with coal-fired plants of comparable size, and is even competitive, considering the electricity generating cost of large LWRs. In view of the steadily increasing scarcity of energy resources in parallel with a dramatic growth of world population, the HTR 500 with its excellent safety characteristics and environmental compatibility is capable of furnishing an important contribution to the solution of the energy problems in the Third World. (author). 6 figs, 1 tab.

44239 (IAEA-TECDOC--541, pp. 285) **Modular high temperature reactor for various applications.** Leuchs, U. (Internationale Atomreaktorbau GmbH (INTERATOM), Bergisch Gladbach (Germany, F.R.)); Steinwarz, W. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The HTR-Module is designed as an unsophisticated, safe and economic heat source for various applications. The reactor can be coupled without major modifications to a steam generator for the production of steam and power or to steam reformers or intermediate heat exchangers for the direct use of nuclear heat. Due to its special design the HTR-Module achieves an extremely high passive safety level. This allows its erection at industrial sites in populated areas. (author).

44240 (IAEA-TECDOC--541, pp. 299-307) **The modular high temperature gas cooled reactor (prismatic fuel).** Holm, H. (Gulf General Atomic Europe, Zurich (Switzerland)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

This paper describes the characteristics of modular high-temperature gas-cooled reactor (MHTGR) such as passive and inherent safety, economic competitiveness and its suitability in many developing countries for electrical and process heat needs. General Atomics (GA) proposes the consideration of a reference MHTGR which consists of four identical 350 MW(t) reactor modules and two turbogenerator sets to achieve a plant output of 538 MW(e). A vertical cylindrical concrete enclosure fully embedded in the earth is used for housing each reactor module. Important advantages of this electrical generating system for a developing country have also been described such as simplicity, minimal investment risk, modularity, minimal transportation requirements for fuel supply, insensitivity to price increases and process heat capability. The performance of MHTGR is dependent on the reliable operation of major components/systems such as reactor vessel, helium circulation, steam generator, control rod drives, fuel and power conversion system etc. The advantage is that the technologies of these components/systems are well proven since 1956. (author). 4 figs.

44241 (JAERI-M--90-033) **Experimental test results of multi-channel test rig of T_1 test section, 3: Test results in helium gas conditions heated to 1000 degC.** Hino, Ryutaro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takase, Kazuyuki; Miyamoto, Yoshiaki; Maruyama, Soh. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 43p. (In Japanese). Order Number DE90513794. Source: NTIS (US Sales Only), PC A03/MF A01.

Experimental studies on thermal and hydraulic performance of a fuel column have been performed with the multi-channel test rig of the fuel stack test section (T_{1-M}) installed in the helium engineering demonstration loop (HENDEL). Present report showed experimental results and numerical analysis obtained by a high temperature test that helium gas was heated up to 1000 degC, using 12 simulated fuel rods in T_{1-M}. Under the conditions of uniform heating of 12 simulated fuel rods installed in the fuel block, it was found that a flow rate distribution of helium gas in 12 fuel channels was almost uniform, radiant heat from the fuel rod was increased

with surface temperatures of the fuel rod more than 20 % in laminar flow region, and average heat transfer coefficients agreed with the correlation obtained by the single-channel test rig. On the other hand, the temperature distribution in the horizontal cross section of the fuel block with power distributions of 12 fuel rods was calculated with a three dimensional thermal analysis code, and the temperature difference was found to be small. (author).

2104 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated

Refer also to citation(s) 44226, 44237, 44302, 44314, 44330

44242 (ENEA-RT-COMB–89-23) **Assuring the completeness of closure welds in CIRENE fuel elements.** Sejnoha, R.; Magnoli, L. ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile. Jan 1990. 13p. (CONF-891050–1: 2. international conference on CANDU fuel, Chalk River (Canada), 1-5 Oct 1989; RT/COMB–89-23). Order Number DE90514474. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at 2nd international conference on candu fuel (Chalk River, 1-5 Oct 1989).

A high level of product quality was achieved in the end cap welding of CIRENE fuel elements, thanks to development of the initial sheat/end cap contact geometry and parameters of the welding process itself. Successful qualification and manufacturing demonstration confirmed the adequacy of the process for production of reliable nuclear fuel. The approach and principles used in this program can be applied to other types of fuel with a similar design.

44243 (ETDE-IT–90-24) **Enhancement and testing program for computerized procedure manual (COPMA).** Federico, A.G.; Perugia, A.; Sepielli, M.; Larsen, J.S.; Nilsen, S.; Owre, F. ENEA, Rome (Italy). Oct 1988. 9p. (CONF-8910446–1: 7. European annual conference on human decision making and manual control, Paris (France), 18 Oct 1989). Order Number DE90514422. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 7th european annual conference on human decision making and manual control (Paris, 18-20 Oct 1988).

Computerizing operations procedures seem to be a promising step toward safer and more efficient industrial plant conduction. To explore the issue, an ENEA and Halden Reactor Project (HRP) joint program is currently under way, based on a prototype system. The system, called COPMA (COmputerized Procedure MAnual) has been developed by HRP. Its features are: multiwindow and multiprocess man-machine interface, use of A.I. techniques such as a symbolic languages Prolog and Lisp machine T.I. EXPLORER II. At ENEA laboratories, the COPMA system will be linked to a PWR nuclear power plant engineering simulator as well as a thermohydraulic experimental facility. Structural analysis of operating procedures of different types of plants will provide indications for improving the capability of COPMA specification language and man-machine interface. This research will be connected with other research issues conducted at ENEA and HRP in the field of expert systems and artificial intelligence applications for advanced supervisory systems.

44244 (IAEA-TECDOC–541, pp. 283) **CANDU 3: Technical review and status.** Hart, R.S. (Atomic Energy of Canada Ltd., Mississauga, ON (Canada). Advanced Concepts). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

CANDU-3 is the latest and smallest Canadian PHWR for electricity generation. Rated at 450 MWe, CANDU-3 offers a highly flexible plant configuration, adaptable to a wide range of different user requirements and sites. Simplified component installation and extensive use of pre-assembled modules has shortened the construction schedule to less than three years. CANDU-3 should have particular appeal to countries without hydro or economic fossil fuel resources, countries with small or subdivided grid systems, and countries wanting to develop a nuclear industry with minimum investment. (author).

44245 (IAEA-TECDOC–541, pp. 309-319) **A once-through Th/LEU fuel cycle and its impact on a long-term scenario based on CANDU-type reactors.** Andreescu, N. (Institutul de Reactori Nucleari Energetici, Pitesti (Romania)); Lungu, S.; Ursu, I. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Prospects for extended PHWRs' lifetime up to 100 years were presented at the recent (1986) European Nuclear Conference. Even for a shorter lifetime a long-term solution for reactor fuelling is needed. Therefore, the reprocessing requirements for the transition from the once-through operation mode to a recycle operation mode is an important factor. Feasibility studies were performed at INPR for different PHWR once-through fuel cycles, namely: natural uranium (UN), slightly enriched uranium (SEU) and thorium enriched uranium (Th/LEU), taking into account the corresponding reprocessing requirements for the transition to the recycle mode. The report presents the result of a prefeasibility study dedicated to a Th/LEU fuel cycle using standard (37 fuel pins) bundles consisting of 19 LEU (4% enriched) pins surrounded by 18 Th pins (i.e. the outer pin ring). Both LEU and Th fuel pins are of graphite disc-oxide fuel type suitable for high power and extended burnup. LEU pin irradiation results at NRU (Canada) between 5000 and 33,000 MWd/t at linear powers between 300 and 700 W/cm presented by AECL reveal excellent behaviour, as well as the irradiations in 60 MW - Gentilly 2 PHWR up to 10,000 MWd/t. We expect similar behaviour of the Th pins. When compared with UN and SEU fuel cycles, the Th/LEU once-through cycle is singled out by its lower requirements, as far as development of reprocessing capacities. If a three step development is required in the first two cases (20-100, 200-400 and 800-1600 tonnes/year reprocessing unit capacities), then two steps would suffice in the second case (20-100 and 200-400 t/y). The required reprocessing capacity would be lower by a factor of 4 to 10. The report also presents a Data Base elaborated at INPR for this Th/LEU cycle in 600 MWe CANDU PHWR. (author). 12 refs, 5 figs, 5 tabs.

2105 Power Reactors, Breeding

Refer also to citation(s) 44261, 44287, 44307, 44313, 44329, 44361, 45611, 45952, 45986

44246 (CEA-CONF–9987) **RCC-MR Simplified analysis against buckling.** Autrusson, B.; Acker, D.; Hoffmann, A. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1989. 57p. (CONF-890721–: Joint ASME/JSME pressure vessel and piping conference, Honolulu, HI (USA), 23-27 Jul 1989). Order Number DE90514568. Source: NTIS (US Sales Only), PC A04/MF A01.

To facilitate the design of these structures, the Department of Thermal and Mechanical Studies (DEMT/SMTS/RDMS) and the RAMSES Committee at Commissariat a l'Energie Atomique have developed a simplified analysis method for instantaneous buckling due to monotonic loading for the French Fast Reactor design and building Code (RCC-MR). The RCC-MR imposes buckling design rules for Class I components in paragraph RB 3270, and for class II components in paragraph RC 3270. The practical analysis methods are presented in volume Z, appendix A7 of the same code. This report is intended to: 1 - Present the simplified analysis method in appendix A7, volume Z of the RCC-MR 2 - Present its

experimental validations around 100 experimental results 3 - Compare this method with those proposed by the ASME code, section III, paragraph NB 3130 for class I components, and Code Case N 284 for containments. This comparison is carried out for cylinders under axial compression, cylinders with external pressure, and spheres under external pressure.

44247 (DNE-R–16) **Natural convection cooling of liquid metal systems: A review.** Webster, R. UKAEA Dounreay Nuclear Power Development Establishment (UK). Feb 1990. 112p. Source: Available from H.M. Stationery Office, price Pound 7.00.

The recognition that natural convection offers the prospect of an important inherent safety feature for liquid metal cooled reactor systems has provided the impetus for a world-wide research effort over the past decade. Whilst this research has been based on experiment, both plant experiments and out-of-pile experiments, the enormous advances in the development of computing power in recent years have enabled complementary programmes of mathematical modelling through numerical simulation of the transport equations in three spatial dimensions. These not only offer considerable promise for the designer in projecting the behaviour from experiments and prototype plant to full scale plant, they have also proved to be of considerable value in helping us to interpret and understand the results of the experiments themselves. This paper attempts to review the progress made with the emphasis on decay heat removal by natural convection in the pool-type system. (author).

44248 (ETDE-IT–90-43) **Numerical and experimental analysis of schock effects on the seismic response of LMR core elements.** Martelli, A.; Cecchini, F.; Forni, M.; Neri, P.; Sartori, C.; Bonacina, G.; Labanti, M. ENEA, Bologna (Italy). Dipt. Reattori Veloci. Apr 1989. 16p. (CONF-8904371–3: International topical meeting on pressure vessel technology and nuclear codes and standards, Seoul (C is not a valid Country Code.), 19 Apr 1989). Order Number DE90514518. Source: NTIS (US Sales Only), PC A03.

Paper presented at the international topical meeting on pressure vessel and nuclear codes and standards (Seoul, 19-21 Apr 1989).

The effects of shocks occurring in an earthquake might greatly affect the dynamic and structural response of liquid metal reactor cores. To provide an example of test methodologies developed, this paper presents the main features and results of the detailed experimental and numerical analyses which were performed in the framework of the seismic verification of the Italian PEC reactor core. These studies included shaking table tests on a mock-up of core elements (in full scale with excitation increasing up to the safe shutdown earthquake), non-linear numerical analysis of the test results, static and dynamic fatigue and collapse experiments taking into account temperature effects, and finally, three-dimensional structural calculations.

44249 (IAEA-TECDOC–541, pp. 167-174) **Fast reactor technology development in China.** Xu Mi (Institute of Atomic Energy, Beijing, BJ (China). Dept. of Reactor Engineering and Technology). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

It is important for all the vast countries in the world to consider the strategy of various energy resources, as is also the case for China. The Government has decided to adopt nuclear energy as the supplementary or replacement energy for the regions lacking in general energy resources. Qin Shan 300 MWe PWR and Da Ya Bay 2x900 MWe PWR are under construction. They mark the beginning of the nuclear power programme of China. However, there are not enough uranium resources in China according to recent exploration. As we know the uranium resources in China that could be used for civil applications would be sufficient to provide fuel only for about 15 GWe for 30 years in the case of thermal reactors operating on the one-through cycle (based on U-235), that is the reason why China is interested in the development of fast breeder reactors. Since the late 1960s, a small group of people has begun the basic research work on FBR in China with only a small amount of funds and material resources. The emphasis of research work was put on the core neutronic physics, thermo-hydraulics, sodium purification and impurity analysis, compatibility of materials with sodium and some sodium facilities on a small scale. So far more than ten miniature sodium loops and facilities have been set up. As the first step of FBR technology development in China, we plan to construct an experimental fast reactor of 25-50 MWe around 2000 to get experience in FBR design construction and operation. The main technical options and some initial design boundary conditions have been preliminarily decided for this reactor. (author). 1 ref., 2 figs, 4 tabs.

44250 (IAEA-TECDOC–541, pp. 287-298) **Rational restart of safer fusion energy utilization depending on the small thorium molten-salt power stations.** Furukawa, K. (Tokai Univ., Hiratsu, Kanagawa (Japan). Inst. of Research and Development). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

In the next century, (a) environmental impact of CO_2, SO_x, NO_x and CH_4 from fossil fuel systems, and (b) radiowaste and nuclear proliferation (terrorism) troubles mostly coming from trans-U elements (including several thousand tons Pu) in the U-Pu solid-fuel nuclear power-stations would become severe problems in the world. To get more rational world-wide applicable power-stations as civilian utility facilities, not only the above problems (a) and (b) but also the following should be solved: (c) resource, (d) technological safety and simplicity, (e) flexibility in size and siting, and (f) integral economy in fuel cycle. A new strategy named "THORIMS-NES" (Thorium Molten-Salt Nuclear Energy Synergetics) is being proposed by us, which comprises of the three technologies: (I) Thorium, (II) Molten-Salt and (III) separation of power-stations and fissile breeding plants, refusing fission breeders. The typical 155 MWe Small Molten-Salt Power Station (FUJI-II) has significant characteristics as follows: (i) no needs of graphite exchange and continuous chemical processing except fission-gas removal, and (ii) fuel self-sustainability (no fissile supply) in full life after initial 500 days operation, which mean very low excess-reactivity (nearly no control-rods), few fuel transport, no core melt-down, easy operation and maintenance, few radiowaste and thermal pollution, high thermal efficiency and medium-temperature heat supply, etc. mostly achieving the targets mentioned in the above. This FUJI could be developed in this century at a small cost, smoothly joining with the present energy technologies (including the molten Na reactor technology). (author). 9 refs, 3 figs, 3 tabs.

44251 Interpretation of noise coherence function measurements in liquid-metal fast breeder reactor critical assemblies. Sanda, T. (Power Reactor and Nuclear Fuel Development Corp., Oarai, Ibaraki (Japan). Oarai Engineering Center). *Nuclear Science and Engineering (USA)*, 104(2): 135-144 (Feb 1990).

An improved technique for inferring the eigenvalue separation, which is important in spatial stability analysis, has been developed using the noise coherence function. It was applied to fast reactor critical assemblies of various sizes and compositions that exhibited a wide range of spatial decoupling. In each experiment, four lithium-glass detectors were used to measure noise coherence functions. Various ratios of the coherence functions were used to obtain the first two modes of separation considering higher odes and variations in detector efficiencies. The eigenvalue separation obtained by noise analysis agreed well with calculation.

44252 Cladding corrosion and hydriding in irradiated defected Zircaloy fuel rods. Clayton, J.C. (Westinghouse Electric

Corp., West Mifflin, PA (USA). Bettis Atomic Power Lab.). *Corrosion (Houston) (USA)*, 45(12): 996-1002 (Dec 1989).

Twenty-one LWBR irradiation test rods containing ThO_2-UO_2 fuel and Zircaloy cladding with holes or cracks have operated successfully. The irradiation tests were performed in the Engineering test Reactor (ETR) and the Advanced Test Reactor (ATR) at the Idaho National Engineering Laboratory and in the National Research Experimental Reactor (NRX) located at Chalk River. Zircaloy cladding corrosion on the inside and outside diameter (ID and OD) surfaces and hydrogen pickup in the cladding were measured. The observed OD Zircaloy corrosion oxide thicknesses of the test rods were similar to thicknesses measured for nondefected irradiation test rods. An analysis model gave results that a were in reasonable agreement with the OD oxide thicknesses both of defected and non-defected rods. When the analysis procedure was modified to account for additional corrosion proportional to fission rate, the calculated values agreed well with measured ID oxide corrosion film values of defected rods. Hydrogen pickup in the defected rods was not directly proportional to local corrosion oxide weight gain as was the case for nondefected rods.

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

Refer also to citation(s) 44360

44253 (IAEA-TECDOC–541, pp. 321) **Design and safety features of the AMPS nuclear electric plant.** Oliva, A.F. (ECS Group of Companies, Ottawa, ON (Canada)); Hewitt, J.S. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988*. Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

This paper describes the key design features of the Autonous Marine Power Source (AMPS) plant with special emphasis on safety aspects. The AMPS plant, initially conceived for commercial submarine applications, utilizes a low pressure, low temperature reactor heat source coupled to a low temperature organic Rankin cycle engine generating electric power. The strategy employed in the design of AMPS has been to identify design features which are conducive to minimize design and operating complexity and enhancing safety and reliability. A number of innovations vital to meet the special demands of the AMPS application have been incorporated in its design. The Autonomous Marine Power Source plants have a number of intrinsic safety features designed to minimize the likelihood of fuel failures or core damage as a consequence of fuel overheating following postulated design basis accidents. The AMPS development programme which is underway since 1985 has also been described in this paper. (author).

44254 (JAERI-M–90-040) **Dynamic simulation analysis for nuclear ship reactor: Application to 'Mutsu' plant.** Nabeshima, Kunihiko (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kusunoki, Tsuyoshi; Shimazaki, Junya; Shinohara, Yoshikuni. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 127p. (In Japanese). Order Number DE90513745. Source: NTIS (US Sales Only), PC A07/MF A01.

This report describes plant models in a nuclear ship plant dynamic analysis code and calculated results for the nuclear ship 'Mutsu' plant with this code. A nuclear ship reactor needs to have more stable and safer characteristics for rapid and large load changes and better load following capability than a land PWR plant. A nuclear ship reactor has its peculiar secondary system to convert directly the generated steam energy into the driving power. This dynamic analysis code has been developed by combining the primary system for a PWR plant and the secondary system peculiar to the nuclear ship and used for the simulation of the nuclear ship 'Mutsu'. (author).

2107 Regulation and Licensing

Refer also to citation(s) 44319, 44346

44255 (NUREG–0040-Vol.14-No.1) **Licensee contractor and vendor inspection status report: Quarterly report, January 1990–March 1990.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards. Jul 1990. 200p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A10/MF A01 - GPO; OSTI; INIS.

This periodical covers the results of inspections performed by the NRC's Vendor Inspection Branch that have been distributed to the inspected organization during the period from January 1990 through March 1990.

44256 (NUREG–0540-Vol.12-No.6) **Title list of documents made publicly available, June 1–30, 1990: Volume 12, No. 6.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Aug 1990. 330p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A15/MF A01 - GPO; OSTI; INIS.

This monthly publication, contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes docketed material associated with civilian nuclear power plants and other uses of radioactive materials and nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979.

44257 (NUREG–0750-Vol.31-No.6) **Nuclear Regulatory Commission issuances, June 1990: Volume 31, No. 6.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Jun 1990. 129p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A07/MF A01 - GPO; OSTI; INIS.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

44258 (NUREG–1214-Rev.6) **Historical data summary of the systematic assessment of licensee performance: Revision 6.** Allenspach, F.; Wharton, R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Licensee Performance and Quality Evaluation. Aug 1990. 111p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A06/MF A01 - GPO; OSTI; INIS.

The Historical Data Summary of the Systematic Assessment of Licensee Performance (SALP) is produced periodically by the US Nuclear Regulatory Commission. This summary provides the results of the assessment for each facility by NRC region and is further divided into the following sections: Section 1 presents the most recent SALP report ratings for facilities in operation and under construction. Section 2 presents a chronological listing of all SALP report ratings for each operating facility. Section 3 presents a chronological listing of all SALP report ratings for each facility under construction. For historical purposes, past construction ratings for facilities that recently have been licensed also are listed in Section 3.

44259 (NUREG–1409) **Backfitting guidelines.** Allison, D.P.; Conran, J.M.; Trottier, C.A. Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data. Jul 1990. 99p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

The backfitting process is the process by which the US Nuclear Regulatory Commission (NRC) decides whether to issue new or revised requirements or staff positions to licensees of nuclear power reactor facilities. Backfitting is expected to occur and is an inherent part of the regulatory process. However, it is to be done only after formal, systematic review to ensure that changes are properly justified and suitably defined. Requirements for proper justification of backfits and information requests are provided by two NRC rules,

Title 10 of the Code of Federal Regulations, Sections 50.109 and 50.54(f). Three types of backfits are recognized. Cost-justified substantial safety improvements require backfit analyses and findings of substantial safety improvement and justified costs. Two types of exceptions, compliance exceptions and adequate protection exceptions, do not require findings of substantial safety improvements and costs are not considered. However, they are still backfits and they require documented evaluations to support use of the exceptions. Information requests (as opposed to backfits) require an analysis of the burden to be imposed to ensure that they are justified in view of the potential safety significance of the information requested. NRC procedures on backfitting include the Charter of the Committee to Review Generic Requirements for generic communications and NRC Manual Chapter 0514 and individual office procedures for plant-specific communications. Considerable guidance has been developed, control mechanisms are in place, and training has been provided to NRC and industry personnel.

44260 (REG/G–1.159) **Assuring the availability of funds for decommissioning nuclear reactors.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research. Aug 1990. 58p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

The general requirements for applications for license termination and decommissioning nuclear power, research, and test reactors are contained in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." On June 27, 1988, the Commission published amendments to 10 CFR Part 50 (53 FR 24018) concerning specific criteria for decommissioning nuclear facilities. Amended 10 CFR 50.33(k), 50.75, and 50.82(b) require operating license applicants and existing licensees to submit information on how reasonable assurance will be provided that funds are available to decommission the facility. Amended § 50.75 establishes requirements for indicating how this assurance will be provided, namely the amount of funds that must provided, including updates, and the methods to be used for assuring funds. This regulatory guide has been developed in conjunction with the rule amendments and was published for public comment in May 1989. This version incorporates, where appropriate, the public comments received. Its purpose is to provide guidance to applicants and licensees of nuclear power, research, and test reactors concerning methods acceptable to the NRC staff for complying with requirements in the amended rule regarding the amount of funds for decommissioning. It also provides guidance on the content and form of the financial assurance mechanisms indicated in the rule amendments. 9 refs.

44261 DOE funds for nuclear reactor research called inadequate. *Power Engineering (USA)*, 94(3): 11 (Mar 1990).

This paper discusses the Department of Energy's R and D budget. The author argues that most of the monies have been redirected to support the space and defense programs while a small and decreasing portion of the nuclear R and D budget is supporting programs leading to commercialization of new reactor technologies.

2108 Economics

Refer also to citation(s) 44007, 44227, 44238, 44240, 44245, 44261, 44309, 44313, 44331, 44450

44262 (GAO/RCED–90-60FS) **Information on award fees paid at selected DOE facilities: Nuclear health and safety.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 13p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that the Department of Energy uses award fees to encourage effective work and to improve the quality of performance by its contractors. These fees are in addition to reimbursing the contractor for its cost and any possible base fees. Such fees are determined through DOE's evaluations of a contractor's performance. This report's review of award fees paid by DOE at six facilities during fiscal years 1987 and 1988 found that contractors at five of the six facilities were rated by DOE as very good to excellent for their overall performance and received award fees ranging from $1.4 million to nearly $10 million.

44263 (IAEA-TECDOC–541) **The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna 27-30 June 1988 and 6-9 December 1988.** International Atomic Energy Agency, Vienna (Austria). Feb 1990. 332p. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Also includes the papers presented at the technical committee meeting and workshop on design requirements for the application of advanced concepts in developing countries, Vienna, 6-9 December 1988.

The document includes the papers presented at the following two technical committee meetings organized by the IAEA: Technical Committee Meeting and Workshop on Criteria for the Introduction of Advanced Nuclear Power Technologies for Specific Applications in Developing Countries, Vienna, 27-30 June 1988 (14 papers) and Technical Committee Meeting and Workshop on Design Requirements for the Application of Advanced Concepts in Developing Countries, Vienna, 6-9 December 1988 (16 papers). A separate abstract was prepared for each of these papers.

44264 (IAEA-TECDOC–541, pp. 45-54) **The application of HTR in Indonesia.** Djokolelono, M. (National Atomic Energy Agency, Jakarta (Indonesia)); Subki, I. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

A prefeasibility study of the application of HTR in Indonesia, namely for the heavy oil recovery in the Duri oil field, was completed and reported to the Indonesian Government. The study was performed under the cooperation between KWU, Interatom of the Federal Republic of Germany and BATAN, BPPT, MIGAS, LEMIGAS, Pertamina of Indonesia. From the Duri steam flood requirement 4 units of 4 HTR 200-MWt-Modules were exercised and positive results were obtained. Various advantages, economic and technological, on the use of nuclear steam supply systems over conventional crude-burning ones were identified. Later an economic study of only one unit introduction, resulting in similar positive results, was also presented by KWU. Whilst uncertainties associated with assumptions still have to be verified through a comprehensive feasibility study, some issues are hindering the decision to proceed. Among others are short term practice of oil production sharing contracts, actual low oil price, optimistic view of the availability of other energy resources, institutional and safety aspects. (author). 5 refs.

44265 (IAEA-TECDOC–541, pp. 55-71) **Perspectives for advanced nuclear power technology applications in the development of the Venezuelan Orinoco Oil Belt.** Carvajal-Osorio, H. (Instituto Venezolano de Investigaciones Cientificas, Caracas (Venezuela)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Venezuela has the world's greatest deposits of extra-heavy oil located at the Orinoco Oil Belt, estimated to contain 1-2x10^{12} barrels of crude oil. In addition, deposits other than the Orinoco Oil Belt, containing around 260x10^{9} barrels of oil with less than 14 ^{0}API,

have been identified in the country. Assuming a recovery of just 15-20%, Venezuela could sustain a production rate of $2x10^6$ bpd during more than two centuries. So it becomes of great importance for Venezuela to develop and to make these energy reserves available, not just for its own benefit, but for the rest of the world. Steam injection is the most promising method for heavy oil extraction. Also, it is unavoidable to process this kind of oil to obtain useful commercial products. Both the extraction and the processing require substantial amounts of medium and high temperature process heat, implying a large demand of energy which might even get close to a negative net energy balance if inefficient energy production methods are employed. Recent important developments in advanced nuclear power technologies open new possibilities which demand their consideration as the main energy sources in the Orinoco Oil Belt development. Moreover, it has been found that extra amounts of hydrogen are required for obtaining light synthetic crudes from heavy oil. High temperature reactors represent a valid option for the production of the required hydrogen. Additional perspectives appear for the future as abundant hydrogen produced by nuclear plants might be used as an energy transportation mean to supply part of the energy demand of the main populated centers of Venezuela. This paper covers a preliminary study, indicating good perspectives for the use of nuclear energy in the exploitation of the extra-heavy oil resources from the Orinoco Oil Belt. (author). 11 refs, 7 figs, 2 tabs.

44266 (IAEA-TECDOC–541, pp. 17-20) **China's energy situation.** Fang Zhishi (Ministry of Nuclear Industry, Beijing, BJ (China)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The paper describes China's energy situation, reasons for the development of nuclear energy, recent progress of nuclear power projects. China has rich resources, its coal and water resources occupy the top places in the world, but are not well distributed. Uranium resources also can be used for the development of nuclear energy. Coal takes around 70% of the primary energy consumption, it will certainly make the rail congestion and the environment pollution even worse. Systematic studies have been made in order to formulate a strategy that could solve China's long term energy demand. It has been unanimously agreed that nuclear power is the most realistic solution. Construction of 300 MWe PWR at Qinshan Nuclear Power Plant and twin 900 MWe PWR at Daya Bay Nuclear Power Plant is going ahead. The feasibility of Qinshan second stage of two 600 MWe PWR units has been studied for some time and is still investigated in depth. China's target for nuclear power capacity in Qinshan and Daya Bay is 4500 MWe by the year 2000. Further nuclear power plants will be constructed according to investment possibility. Nuclear power will play an important role in the next century, tentative object by 2015 is 30000 MWe. (author).

44267 (IAEA-TECDOC–541, pp. 21-39) **Nuclear power prospects in the Arab world.** Abdel-Gawad Emara, A.S. (Atomic Energy Authority, Cairo (Egypt). Nuclear Chemistry Dept.). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

A world outlook of the share in energy supply and demand for developing and developed countries is given. With respect to nuclear energy and according to recent estimates by the World Energy Conference, the share of nuclear power in the world energy mix will be limited varying from 4% by the year 1985 to 14% by the year 2060. The Arab energy situation was also presented. It is shown that Arab countries should have a policy to ensure both the diversification of their energy sources and the acquisition of know-how to produce the energy they need. Nuclear energy can be considered as a relatively accessible energy alternative. Social political and economic factors should be properly considered before any decision about the preference of any energy source. Studies related to estimates about future nuclear energy prospects in the Arab world appear to be overoptimistic. A regional development of nuclear energy is recommended especially in the field of uranium exploration and extraction. Any nuclear programme should be viewed as a developmental programme of a regional multinational developmental project. "A Pan Arab Nuclear Fuel Cycle" should be reconsidered. An Arab energy institute for promotion of research activities and implementation of energy planning programmes is proposed. (author). 14 refs, 4 figs, 2 tabs.

44268 (IAEA-TECDOC–541, pp. 41-44) **Prospects for future reactor utilization in China.** Fang Zhishi (Ministry of Nuclear Industry, Beijing, BJ (China)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The utilization of nuclear energy as district heating describes the situation of present residential heating, advantages of nuclear heat supply, adaptation of low-temperature nuclear heat reactors. It is planned first to build one or two low-temperature nuclear heat reactors in appropriate northern cities of China in the 1990s. Take the example of the city Qiqihar in Northeast China, it is estimated that if the district heat supply system installed with 400 MWth low temperature heat reactor, the consumption of around 300,000 tons coal could be saved, it would mitigate rail congestion and reduce environmental pollution. Utilization of nuclear energy as district heating is favorable in cold regions, that is the Northeast, Northwest and North China areas. Nuclear heating cost will be lower than conventional coal fire heating by comparison. The research work on FBR, the plan for building experimental FBR, and research work on fusion technology referring to advanced reactors are described. FBR, the next generation reactor, is important for economic utilization of nuclear fuel due to its inherent function of breeding fissile materials. Research work of FBR has been carried out for several years, 50-100 MWth experimental FBR will be built before the year 2000. Feasibility study of HTRGR has been carried out in recent years. Efforts have also been devoted to research and development work of the advanced light water reactors and fusion technology. China will vigorously promote the peaceful application of nuclear energy in national economy and its people's life by fully utilizing the existing nuclear industry and technology. International cooperation in nuclear field cannot only bring benefit to both developed and developing countries but accelerate the peaceful application of nuclear energy in the world.

44269 (IAEA-TECDOC–541, pp. 73-83) **Techno-economical prerequisites for the use of nuclear energy sources for district heating.** Ivanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The paper describes that at present there are technoeconomical prerequisites for extensive introduction of the nuclear power plants

not only for electricity generation but also for residential district heating in USSR. More than 60% of all fuel and energy resources are being consumed for industry and residential district heating. For economical reasons the plants for district heating must be built near the consumers, so their deign should practically completely eliminate any possibility of occurrence of severe accidents e.g. as low as 10^{-6} to 10^{-7} per year of unit operation. This enhancement in safety can be achieved by improving the factors such as reactor safety, design, equipment reliability etc. In USSR a number of nuclear power plants with enhanced safety features and with a capacity of 50-500 MW are being developed both for district heating and heat plus electricity generation. Technoeconomical studies have been carried out at I.V. Kurchatov Institute and mathematical models of nuclear district heating plants and heat networks have been developed. In the northern and north-eastern areas of USSR the nuclear power plants with relatively low capacity may prove to be competitive. During a first stage of district heating water-water reactors can be used but the use of the HTGR is also possible at a later stage. VG-400 and low-power modular reactors HTGR-M are being developed in the USSR. The first one is designed for cogeneration of high temperature heat, steam and electricity. A second one will be used for large industrial complexes where a high reliability of energy supply is required in the continuous processes. (author). 3 refs, 3 figs, 2 tabs.

44270 (IAEA-TECDOC–541, pp. 85-92) **The use of nuclear power in remote isolated regions.** Baranaev, Yu.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Sergeev, Yu.A. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Northern and north-eastern regions of USSR have many kinds of mineral raw materials, rare and precious metals, diamonds and some other valuable natural resources, but their developments are limited due to shortage of power supply. As a result, fuel cost, as well as electric power and heat cost in these regions are substantially higher than developed regions of the country, which becomes the most important prerequisite for the efficient use of nuclear fuel. However, the construction and operation of nuclear power plants in these regions is difficult due to a number of factors such as extremely severe natural and climate conditions, poorly developed industrial and economic infrastructure, seismicity and lack of water. Small nuclear power plants with power units of up to 100-150 MWt designed for combined electric power and heat or only heat generation have good prospects in these remote isolated regions of USSR, but the design of these plants should be based on the concept of practical elimination of a dangerous radioactive impact for the nearby areas under any accidents. There are a number of ways and approaches for increasing their efficiency e.g., reduction of cost and time of construction and putting into operation, using maximum degree of plant prefabrication, updating of current safety regulation codes, rationalization of spent fuel handling, increasing of capacity factor and utilization of heat removal from turbine condensers. The USSR has experience of the construction and long-term trouble free operation of the Bilibino nuclear power and heat generation plant with a number of units of 12 MWe each, as well as the Kolskaya nuclear power plant with WWER-400 reactors in the Murmansk district. (author). 1 ref.

44271 (IAEA-TECDOC–541, pp. 93-96) **Incentives for advanced nuclear power technology.** Abdel-Gawad Emara, A.S. (Atomic Energy Authority, Cairo (Egypt). Nuclear Chemistry Dept.). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The implementation of a nuclear power programme in Egypt has been delayed as a result of problems related to financing of the project, public criticism and opposition to the source of energy itself and unfavorable national and international circumstances originating after the accident at Chernobyl. Concerned officials and planners are unanimous about the suitability and competitiveness of nuclear power as an energy source which can have a large share in the energy mix proposed to satisfy the growing energy needs of the country. (author). 2 refs.

44272 (IAEA-TECDOC–541, pp. 129-140) **Criteria for the introduction of the slowpoke energy system in the People's Republic of China.** McDougall, D.S. (Atomic Energy of Canada Ltd., Ottawa, ON (Canada)); Hao Qingyu. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The criteria for the success of nuclear programs remain unchanged today from those in existence for the last twenty years. The nuclear energy source must fill a 'need' - a need first identified in the form of electricity generating capability. Once this electricity generating need is established, the preferred solution must meet a number of technological and economic criteria. Nuclear technology, when offered for export is assessed for example, by the ability of the host country to pay for the high initial capital cost; and the host country must assess the ability of its grid to absorb a large 'one-time' addition to its power plant inventory. It must assess the ability of the existing infrastructure to cope with the newly introduced technology. The criteria has not changed but the solutions offered are substantially different. Nuclear products now offer solutions to a variety of needs - from large and small electricity units, through space and industrial heat applications to desalination. The nuclear product offering is greater because many of today's nuclear products are simpler and consequently more likely to meet the criteria of need, technological acceptance and economic viability. Public acceptance is also tremendously enhanced. Atomic Energy of Canada Limited (A.E.C.L.) and the Beijing Institute of Nuclear Engineering have carried out a study of the applicability of A.E.C.L.'s Slowpoke Energy System (S.E.S.) in China. This study reviews the criteria for acceptance of the S.E.S. in China. With examination of specific sites, the study highlights the ability of this new nuclear technology to satisfy a newly identified need when measured against accepted criteria of technology transfer. (author). 2 refs, 1 fig.

44273 (IAEA-TECDOC–541, pp. 141-144) **A consultant's view of the use of advanced nuclear reactors in developing countries.** Gibbs, P.K. (Motor-Columbus Ingenieurunternehmung AG, Baden (Switzerland)); Smith, D.; Moll, H.W. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

This paper outlines some of the differences between the institutional, financial and economic problems of a small nuclear steam plant and those of a large power plant. If there are no other nuclear plants in a country then very careful consideration should be given to the institutional problems. In the light of the experience of

MOTOR-COLUMBUS this paper has examined the problems and difficulties of introducing advanced reactor systems such as the HTRs to provide high temperature steam to allow the extraction of oil from heavy crude oil deposits or from tar sands. The most frequent reason for abandoning nuclear power projects in developing countries over the last decade has been the failure to obtain funds. Certain factors have been indicated in this paper which make the provision of funds easier for a small nuclear power plant as compared to a large one. (author). 1 fig.

44274 (IAEA-TECDOC–541, pp. 241-256) **Acceptance of the advanced reactor concept in Indonesia.** Nurdin, M. (National Atomic Energy Agency, Bandung (Indonesia)); Subki, I. International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The new coming concept of nuclear reactors that we call the advanced concept, from their size point of view can be classified into three main categories; small, medium and high power reactor of 900 MWe or more (today commercial nuclear power plant). We try to discuss in this paper our understanding on the advanced concept in which we want to find the match between the condition we have and our needs, with the level/status of the advanced concept today. Besides that, either bilateral or international cooperation is discussed as well in the brief historical evolution of nuclear R and D in Indonesia from 1964 until now. (author). 13 refs.

44275 (IAEA-TECDOC–541, pp. 257-274) **Main design parameters for an advanced nuclear plant for the Venezuelan Orinoco Oil Belt development.** Carvajal-Osorio, H. (Instituto Venezolano de Investigaciones Cientificas, Caracas (Venezuela)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The main design requirements for a steam-supply advanced nuclear plant proposed for both the extraction and the preprocessing of extra-heavy oil from the Orinoco Oil Belt are presented here. The model under consideration is a modular co-generation concept able to supply a large fraction of the energy required by an oil field producing 100,000 barrels per day of refinery ready synthetic oil. Three 1200 Mw(th) high-temperature gas cooled reactors, built successively, would supply most of the process heat, the injection steam and the electricity required, this in accordance with the main design criteria of a high variability of steam demand along the field life-time. The energy balance would be supplied by burning oil processing residues. Although design parameters depend on particular oil deposit characteristics and crude properties which may change with the field location in the OOB, the values established for this model are: process heat maximum conditions of pressure 100 bars at a temperature of 500 deg. C, and for injection steam pressures between 120 to 170 bars to saturation temperatures. Current design studies performed elsewhere, based on high-temperature gas cooled reactors, present design characteristics which could satisfy the requirements of the model under consideration. Further more detailed studies are recommended. (author). 19 refs, 9 figs, 3 tabs.

44276 (IAEA-TECDOC–541, pp. 275-280) **Application studies of HTR in the People's Republic of China.** Zhong, D. (Tsinghua Univ., Beijing, BJ (China). Inst. of Nuclear Energy Technology). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

This paper describes the energy situation, uneven distribution of energy resources and possible applications of HTRs in China. The HTR application in China could be separated into two stages. In first stage the HTR with helium temperature of 750 deg. C can be used for producing electricity and/or process steam for thermal recovery of heavy oil, petrochemical complexes and concentrated industrial areas. In second stage the HTR application in China, will provide high temperature of process heat (up to 950 deg. C) for liquid and gaseous fuel productions. It has been studied that about 200-250 MWe units of modular HTRs with a steam generating capacity in the range of 250 to 350 tons per hour can meet the requirements of steam consumption in the thermal recovery oil fields, which are at present one-sixth of the total Chinese petroleum reserve, and it results in the annual savings of approximately 0.3 million tons of oil. This paper also describes that a study has been started jointly by the China and Federal Republic of Germany, for the application of HTR in petrochemical industry. Design requirements of the HTR for future applications in China such as excellent inherent safety, flexibility of fuel cycle, simple and domestic fabrication of fuel elements, generation of low pressure, high pressure, superheated steam and appropriate capacity (200-350 MW (th)), have been also discussed in this paper. (author). 4 refs.

44277 (INIS-XN–247) **Projected costs of generating electricity from power stations for commissioning in the period 1995-2000.** Nuclear Energy Agency, 75 - Paris (France). 1989. 208p. Order Number DE90637339. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The study reviews the projected electricity generation costs for the base load power generation options expected to be available in the medium term, using an agreed common economic methodology. Cost projections were obtained for nuclear and fossil fuelled plants that could in principle be commissioned in the mid-1990s, or shortly thereafter, although not all countries plan to commission plants at that time. The major changes in expectations compared with earlier studies, apart from those associated with changed perceptions of fossil fuel prices, include significantly lower nuclear investment costs for the United States, associated with an improved design and the expectation of achieving shorter construction periods than projected in the 1985 study, and generally lower nuclear fuel costs. Some countries project higher operation and maintenance costs for either coal-fired or nuclear plant or both. In the case of coal-fired plants these may be associated with the extra costs of operating desulphurisation equipment. The most marked change in nuclear operating and maintenance costs has taken place in the United States, where these costs are now expected to be twice as large as the projected nuclear fuel costs. There remain major differences in investment cost expectations between countries. The reasons for these differences have been examined in previous studies. They arise from differences in factor costs, regulatory approach, design and siting, and exchange rates which do not adequately reflect the differences in the capital investment costs between countries. In brief, most OECD countries continue to expect nuclear power to have a lower levelised generating cost than coal-fired generation when using their own technical and economic assumptions.

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 44198, 44199, 44263, 44348, 46288

2201 Theory and Calculation

Refer also to citation(s) 44312, 44362, 44364, 45994

44278 (JAERI-M–90-058) **Recalculations of criticality data and subcritical limits of low-enriched homogeneous uranium**

fuels. Okuno, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Komuro, Yuichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 177p. (In Japanese). Order Number DE90513800. Source: NTIS (US Sales Only), PC A09/MF A01.

Criticality data and subcritical limits of low-enriched homogeneous uranium fuels were recalculated by the criticality safety evaluation code system JACS according to its re-evaluation. Four kinds of chemical composition were considered, i.e. UO_2-H_2O, ADU(II)-H_2O, UO_2F_2 aqueous solution and $UO_2(NO_3)_2$ aqueous solution. The criticality data and subcritical limits were obtained for infinitely-long cylinder, slab and sphere of fuel, to which 30-cm-thick water was attached. It is shown that the minimum subcritical limits in the Criticality Safety Handbook of Japan do not exceed the present results. (author).

44279 (PSI–67) **Application of the Wiener-Hermite functional method to point reactor kinetics driven by random reactivity fluctuations.** Behringer, K. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Pineyro, J.; Mennig, J. Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland). Jun 1990. 33p. Order Number DE90636992. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Wiener-Hermite functional (WHF) method has been applied to the point reactor kinetic equation excited by Gaussian random reactivity noise under stationary conditions. Delayed neutrons and any feedback effects are disregarded. The neutron steady-state value and the power spectral density (PSD) of the neutron flux have been calculated in a second order (WHF-2) approximation. Two cases are considered: in the first case, the noise source is low-pass white noise. In both cases the WHF-2 approximation of the neutron PSDs leads to relatively simple analytical expressions. The accuracy of the approach is determined by comparison with exact solutions of the problem. The investigations show that the WHF method is a powerful approximative tool for studying the nonlinear effects in the stochastic differential equation. (author) 5 figs., 29 refs.

44280 Effective cross sections and sources in moving material. Wienke, B.R. (Los Alamos National Lab., NM (USA). Theoretical Div.); Hill, T.R. *Nuclear Science and Engineering (USA)*, 104(2): 188-196 (Feb 1990).

The transport equation if formulated against a moving background in the presence of external forces using the effective cross section and source formalism. One-dimensional slab and spherical geometries and two-dimensional cylindrical geometry are treated. Material acceleration terms are expanded, effective cross sections are generated, and moving sources are defined. Legendre expansion that can be coupled to standard multigroup cross sections and sources are suggested. Multigroup representations for the acceleration terms are also obtained. Specific applications are presented and contrasted. The treatment is appropriate for Eulerian reference frames.

2202 Components and Accessories

Refer also to citation(s) 44193, 44248, 44328, 44329, 44342, 44347, 44424, 44425, 44633, 44993, 45188, 45902, 46043, 46284

44281 (CEA-CONF–9986) **Design rules for piping: plastic stability of straight parts under level d loadings.** Touboul, F.; Ben Jdidia, M.; Acker, D. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1989. 34p. (CONF-890721–: Joint ASME/JSME pressure vessel and piping conference, Honolulu, HI (USA), 23-27 Jul 1989). Order Number DE90514569. Source: NTIS (US Sales Only), PC A03/MF A01.

For piping systems, design rules for straight parts, under static loads are based on limit analysis. We have studied the accuracy of such method when different geometries and combinations of loadings are concerned. Analysing theoretical computations, we have pointed out the hypothesis inherent to the formulation used in design codes (ASME, RCCM, RCC-MR). We have determined a formula closer to the theoretical results that we have compared to experiments. We have interpreted up to 170 tests from different laboratories with varied geometries (D/e from 10 to 115) and manifold type of loadings, with or without pressure: pure bending, pure torsion, bending with torsion, combined bending. We have applied the codes rules and we have noticed that for certain tests, experimental ultimate moments were forty per cent lower than the coded one. As geometry is concerned, contrary to the limit analysis prediction, ultimate load does not depend only on the modulus of inertia (Z) but also on the D/e ratio by a $(D/e)^{-33}$ coefficient. As level D service limits were considered, we have taken out the maximal load borne by the tubes. To ensure the conservatism of the rule, the allowable stress for austenitic steels, as defined by codes, must be taken at the value defined by ASME, Section III, Appendix F (criteria for component, F 1331).

44282 (CEGB-RD-B–6147/R89) **Wear scar shapes in tubes and flats - measured data and comparison with theory.** Parry, A.A. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Aug 1989. 8p. (PWR/SGWG/P–(89)537). Order Number DE90636996. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A variety of measurements has been made on the scars on some tube-on-flat impact wear specimens. The results have allowed examination of some of the assumptions made previously in formulating a theory relating the maximum wear depth to the wear volume for this geometry. The assumption that the shape of the scars would be cylindrical was reasonably borne out, as was the part of the theory which predicted that for a specimen pair the ratio of wear depths would be in the ratio of the wear volumes in the scars. The most encouraging result was that wear depths predicted by the theory using the measured wear volumes compared very well with the measured depths. The predicted depths averaged 5% less than the measured ones, with a range of from 3% more to 12% less. As a fraction of the tube wall, the percentages would be considerably smaller. (author).

44283 (CONF-900610–1) **An investigation of crack-tip stress field criteria for predicting cleavage-crack initiation.** Keeney-Walker, J. (Oak Ridge National Lab., TN (USA)); Bass, B.R.; Landes, J.D. Oak Ridge National Lab., TN (USA). [1990]. 42p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 22. national symposium on fracture mechanics; Atlanta, GA (USA); 26-28 Jun 1990. Order Number DE90015597. Source: NTIS, PC A03/MF A01 - OSTI.

Cleavage crack initiation in large-sale wide-plate (WP) specimens could not be accurately predicted from small compact (CT) specimens utilizing a linear elastic fracture mechanics, K_{Ic}, methodology. In the wide-plate tests conducted by the Heavy-Section Steel Technology Program at Oak Ridge National Laboratory, crack initiation has consistently occurred at stress intensity (K_I) values ranging from two to four times those predicted by the CT specimens. Studies were initiated to develop crack-tip stress field criteria incorporating effects of geometry, size, and constraint that will lead to improve predictions of cleavage initiation in WP specimens from CT specimens. The work centers around nonlinear 2-D and 3-D finite-element analyses of the crack-tip stress fields in these geometries. Analyses were conducted on CT and WP specimens for which cleavage initiation fracture had been measured in laboratory tests. The local crack-tip field generated for these specimens were then used in the evaluation of fracture correlation parameters to augment the K_I parameter for predicting cleavage initiation. Parameters of hydrostatic constraint and of maximum principal stress, measured volumetrically, are included in these evaluations. The results suggest that the cleavage initiation process can be correlated with the local crack-tip fields via a maximum principal stress criterion based on achieving a critical area within a critical stress contour. This criterion has been successfully applied to correlate cleavage initiation in 2T-CT and WP specimen geometries. 23 refs., 17 figs., 5 tabs.

44284 (EPRI-NP–5792-SR) **Primer: Fracture mechanics in the nuclear power industry.** Wessel, E.T. (Wessel (E.T.), Murrysville, PA (USA)); Server, W.L.; Kennedy, E.L. Electric Power Research Inst., Palo Alto, CA (USA); Wessel (E.T.), Murrysville, PA (USA); Tenera Corp., Berkeley, CA (USA); Failure Analysis Associates, Inc., Palo Alto, CA (USA). ©1990. 156p. Sponsored by

Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This Primer is intended to familiarize utility engineers with the fracture mechanics technology and to provide the basis for a working knowledge of the subject. It is directed towards all the engineering disciplines that are involved either directly or indirectly with the structural reliability of electrical power generation equipment and systems. These engineering disciplines include such areas as: design and stress analysis, metallurgy and materials, nondestructive inspection and quality control, structural analysis and reliability engineering, chemical engineering and water chemistry control, and architectural engineering. This Primer does not provide a comprehensive, in-depth treatment of all the detailed aspects involved in fracture mechanics. It does, however, provide sufficient information and a common vocabulary that should enable engineers to: read and converse intelligently about the subject, understand and utilize ASME Codes and Regulatory Guides involving fracture mechanics, absorb technical information presented and discussed at various technical meetings, and begin to apply this technology towards actual engineering problems encountered in the course of their work. Example problems are provided to further enhance an understanding of fracture mechanics. Also, Appendix A describes fracture mechanics computer codes available through EPRI to analyze rotors, reactor pressure vessels and piping.

2203 Fuel Elements

Refer also to citation(s) 43988, 44236, 44242, 44330, 44347

44285 (AD-A-221386/6/XAB) **Application of neutron radioscopy to lithium-aluminum alloy target elements. Technical report.** Antal, J.J.; Marotta, A.S.; Salaymeh, S.R.; Varallo, T.P. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. Apr 1990. 15p. (MTL-TR–90-18). Source: NTIS, PC A03/MF A01.

We have shown that neutron radioscopy is very useful in locating the position of a Li-Al alloy core enriched in Lithium-6 in tubular aluminum target elements. The alloy core is displaced during a forming process and its location must be redetermined before processing can be completed. The Army's low-flux mobile neutron radioscopy system was employed in these studies as a model system for possible on-line, in-plant use. A series of core end sections of target tubes containing from 0.1 to 4.6 grams of Lithium-6 per foot of length were examined radioscopically with thermal neutrons. The system was able to determine the extent of lithium alloy core from the highest concentrations down to about 0.2 grams of Lithium-6 per foot within one minute of data collection time.

44286 (PNL-SA–17517) **Transient and static mechanical properties of D9 fuel pin cladding and duct material irradiated to high fluence.** Cannon, N.S. (Westinghouse Hanford Co., Richland, WA (USA)); Huang, F.H.; Hamilton, M.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900623–14: 15. symposium on effects of radiation on materials, Nashville, TN (USA), 17-21 Jun 1990). Order Number DE90016327. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Simulated transient tests and standard static mechanical property tests were performed on irradiated specimens of D9, a low-swelling, advanced austenitic stainless developed for fast reactor operation. Results of the transient tests were compared with existing data on 316 and HT9 stainless steels. The D9 alloy exhibited the same behavior attributed to the fuel adjacency effect (which is characterized by reduced strength and ductility as a result of cladding contact with oxide fuel) observed in 316 stainless steel. In the mechanical property tensile and fracture toughness tests, D9 exhibited a slightly lower fracture toughness than either HT9 or 316 stainless steel. Comparison of tensile strengths indicated that irradiated D9 is stronger than HT9, but slightly weaker than 316 stainless steel. The D9 alloy exhibited a lower tensile ductility than either 316 stainless steel or HT9. The D9 transient and mechanical properties data are now available for computer code analysis of D9 as a fast reactor fuel system material. 15 refs., 12 figs.

2204 Control Systems

Refer also to citation(s) 44226, 44243, 44251, 44424, 44425

44287 (CONF-901090–1) **Reactor coolant pump monitoring and diagnostic system.** Singer, R.M. (Argonne National Lab., IL (USA)); Gross, K.C.; Walsh, M.; Humenik, K.E. Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 2. international machinery monitoring and diagnostic conference; Los Angeles, CA (USA); 22-25 Oct 1990. Order Number DE90011168. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In order to reliably and safely operate a nuclear power plant, it is necessary to continuously monitor the performance of numerous subsystems to confirm that the plant state is within its prescribed limits. An important function of a properly designed monitoring system is the detection of incipient faults in all subsystems (with the avoidance of false alarms) coupled with an information system that provides the operators with fault diagnosis, prognosis of fault progression and recommended (either automatic or prescriptive) corrective action. In this paper, such a system is described that has been applied to reactor coolant pumps. This system includes a sensitive pattern-recognition technique based upon the sequential probability ratio test (SPRT) that detects incipient faults from validated signals, an expert system embodying knowledge bases on pump and sensor performance, extensive hypertext files containing operating and emergency procedures as well as pump and sensor information and a graphical interface providing the operator with easily perceived information on the location and character of the fault as well as recommended corrective action. This system is in the prototype stage and is currently being validated utilizing data from a liquid-metal cooled fast reactor (EBR-II). 3 refs., 4 figs.

44288 (EPRI-NP–6882) **Video camera use at nuclear power plants: Tools for increasing productivity and reducing radiation exposure: Final report.** Estabrook, M.L. (ENCORE Technical Resources, Inc., Middletown, PA (USA)); Langan, M.O.; Owen, D.E. Electric Power Research Inst., Palo Alto, CA (USA); ENCORE Technical Resources, Inc., Middletown, PA (USA). ©Aug 1990. 58p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A survey of US nuclear power plants was conducted to evaluate video camera use in plant operations, and determine equipment used and the benefits realized. Basic closed circuit television camera (CCTV) systems are described and video camera operation principles are reviewed. Plant approaches for implementing video camera use are discussed, as are equipment selection issues such as setting task objectives, radiation effects on cameras, and the use of disposal cameras. Specific plant applications are presented and the video equipment used is described. The benefits of video camera use — mainly reduced radiation exposure and increased productivity — are discussed and quantified. 15 refs., 6 figs.

44289 (ETDE-IT–90-37) **An absolute temperature sensor-actuator for nuclear and industrial applications.** Farello, G.E. ENEA, Casaccia (Italy). Dipt. Reattori Termici. Aug 1989. 20p. (CONF-890819–28: ASME/AIChE national heat transfer conference, Philadelphia, PA (USA), 6-9 Aug 1989). Order Number DE90514512. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 26th national heat transfer conference (Philadelphia, 6-9 Aug 1989).

The development of new type of nuclear reactor characterized by increased passive safety operations is a promising item for the power supply of the 2000s. Within the framework of studies and research in progress for the Italian inherently safe nuclear reactor, a thermal sensor-actuator for the automatic scram of additional control rods was developed. The conceptual design is described and thermal evaluations are presented. The same sensor can be used in industrial components, as for example, to build relief valves in which the absolute temperature instead of the pressure controls the opening. A mechanical design solution for the actuator is presented.

44290 (IAEA-TECDOC–529) **User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee**

meeting held in Vienna, 28 November-1 December 1988. International Atomic Energy Agency, Vienna (Austria). Oct 1989. 207p. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

One limitation of existing information support systems is that the 'end user' (i.e., decision maker) is not properly accounted for in these systems. Therefore, it is needed to consider how the information to be provided by the system is going to be used and to recognize the cognitive decision making process. To discuss how to consider the end user as an integral part of decision support systems (DSS) a Technical Committee Meeting on 'User's Requirements for DSS' was organized by the IAEA in Vienna from 28 November - 1 December 1988. The meeting was attended by 45 participants from 22 countries and international organizations. Sixteen papers have been presented in three technical sessions, which addressed the following areas: Problem identification; design of DSS; user's considerations in DSSs. A separate abstract was prepared for each of these papers. Refs, figs and tabs.

44291 (IAEA-TECDOC--529, pp. 27-36) **Knowledge based diagnostics in nuclear power plants.** Baldeweg, F. (Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)); Fiedler, U.; Weiss, F.P.; Werner, M. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

In the paper to be given a special process diagnostic system (PDS) will be presented, taking into account corresponding user experiences. It must be seen the result of a long term work on computerized process surveillance and control on NPP; it includes a model based system for noise analysis of mechanical vibrations, which has been enhanced by using of knowledge based technique (expert systems). The paper will discuss the process diagnostic frame concept and emphasize the vibration analysis expertsystem RADEX, with the parts modelling (building a knowledge base), man-machine communication aspects, implementation. (author). 5 refs, 5 figs.

44292 (IAEA-TECDOC--529, pp. 97-102) **User involvement in system design of an advanced safety parameter display system for the Forsmark 2 nuclear power plant.** Jacobsson, L. (Swedish State Power Board, Vaellingby (Sweden)); Stenmark, J.E. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

A safety parameter display system is being developed for the Forsmark 2 nuclear power plant. The system should support the plant accident management strategy ranging from handling of transients to severe accidents. This paper summarizes the guiding principles behind the SPDS system development. The system will support the operators decision-making by presenting information in a concentrated form. The system will primarily be a tool for the shift supervisor and closely connected to the emergency operating procedures (EOP). The system will monitor the four critical safety functions; reactivity, core cooling, heat sink and radioactive release barriers. A successful implementation of an SPDS system must in the early design process involve the end users, a new information system must also be strongly connected to existing work routines at the NPP. Human needs and limitations must be carefully considered in the development of computerized operator aids, human factors experts must also be involved in the early design process. Our intention in the Forsmark projects is to use an accurate model of the system end user while developing an SPDS system. This will be done by using a multidisciplinary project group and through active involvement of the end users in the design process. (author). 7 refs.

44293 (IAEA-TECDOC--529, pp. 37-62) **A structural approach to constructing perspective efficient and reliable human-computer interfaces.** Balint, L. (Hungarian Academy of Sciences, Budpest (Hungary). Dept. of Natural Sciences). International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The principles of human-computer interface (HCI) realizations are investigated with the aim of getting closer to a general framework and thus, to a more or less solid background of constructing perspective efficient, reliable and cost-effective human-computer interfaces. On the basis of characterizing and classifying the different HCI solutions, the fundamental problems of interface construction are pointed out especially with respect to human error occurrence possibilities. The evolution of HCI realizations is illustrated by summarizing the main properties of past, present and foreseeable future interface generations. HCI modeling is pointed out to be a crucial problem in theoretical and practical investigations. Suggestions concerning HCI structure (hierarchy and modularity), HCI functional dynamics (mapping from input to output information), minimization of human error caused system failures (error-tolerance, error-recovery and error-correcting) as well as cost-effective HCI design and realization methodology (universal and application-oriented vs. application-specific solutions) are presented. The concept of RISC-based and SCAMP-type HCI components is introduced with the aim of having a reduced interaction scheme in communication and a well defined architecture in HCI components' internal structure. HCI efficiency and reliability are dealt with, by taking into account complexity and flexibility. The application of fast computerized prototyping is also briefly investigated as an experimental device of achieving simple, parametrized, invariant HCI models. Finally, a concise outline of an approach of how to construct ideal HCI's is also suggested by emphasizing the open questions and the need of future work related to the proposals, as well. (author). 14 refs, 6 figs.

44294 (IAEA-TECDOC--529, pp. 63-72) **Contribution of cognitive modelling to the development of decision support system technology.** Cacciabue, P.C. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Decortis, F.; Mancini, G.; Masson, M.; Nordvik, J.P. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

In this paper the needs and requirements for developing a cognitive model of human behaviour are discussed and the architecture of a model of a plant operator, currently being developed, is described in some detail. The potential applications and the perspectives of such type of modelling approach for the development of decision support system are analysed in details. The stand point that we maintain is that the presence of the human being in the man-machine control loop is unavoidable and it represents always the necessary catalyser for any type of prostheses to the decision making process. (author). 22 refs, 1 fig.

44295 (IAEA-TECDOC--529, pp. 73-95) **Man-machine interaction and decision support systems: User modelling and dialogue specification.** Hollnagel, E. (Computer Resources International A/S, Birkeroed (Denmark)). International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision*

support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988. Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Decision support can be given in two quite different ways, either providing the user directly with the information he needs, or by providing him with assistance to find the information he needs. The former approach is traditionally applied in Computerized Operator Support Systems, information systems, and decision support systems. The second approach is to assist the operator in finding the information that is needed in each situation. This overcomes one limitation of the first approach, because it does not require a prior specification of a representative (not to say, exhaustive) set of situations. Instead it requires a specification of the general steps (or generic tasks) that the operator needs to carry out. This can on the most general level be done by referring to a standard decision model. But to be really useful, the decision-making must be seen in the context of the specific process and its characteristic demands, as provided e.g. by a cognitive task analysis. Based on this it is then possible to specify the typical dialogue sequences that are part of the decision-making. This can consequently be used to assist the operator in implementing the dialogue rather than implementing the specific steps (although this may later be added). User modelling in this approach refers to the operator as an active partner in the dialogue, rather than as a process supervisor or controller. The requirements to the Decision Support System will therefore be derived from the context of an overall dialogue, whose goal it is to bring about the decision, rather than from situation-specific requirements which may be mutually conflicting. This second approach works by structuring the situation rather than structuring the tasks. Even though the overall decision- making can be seen as composed of single tasks, the focus is on the organisation (and control) of these tasks rather than the tasks themselves. 11 refs, 4 figs.

44296 (IAEA-TECDOC–529, pp. 115-131) **The use of procedures for decision support in nuclear power plant incidents.** Livingston, A.D. (Human Reliability Associates Ltd., Parbold, Lancashire (UK)). International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331–: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Procedures, particularly Emergency Operating Procedures (EOPs) form a key element of the emergency response capability of operators in nuclear power plants. This paper discusses the effectiveness of procedural support based on a review of the literature and an evaluation of the role of procedures in a selection of post Three Mile Island (TMI) incidents. The evaluation suggests that despite the wealth of human factors research on procedural support, the implementation of this knowledge remains wanting in certain respects. (author). 22 refs.

44297 (IAEA-TECDOC–529, pp. 139-146) **Results from the experimental evaluation of operator decision support systems.** Marshall, E.C. (National Power, Leatherhead (UK)). International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331–: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Prior to joining the CEGB, the author participated in a series of experimental evaluations of proposed operator support systems at the OECD Halden Reactor project in Norway. In these studies reactor operators were systematically observed coping with plant transient on a full-scale PWR plant simulator, both with and without prototype decision support systems. In general, these systems were not based on specific operator models but more on evidence from task analysis and event reports which identified certain task elements as presenting particular difficulties. The operator aids assessed included advanced alarm systems and safety parameter display systems. Overall the operators responded enthusiastically to novel support systems and aspects of performance, measured in terms of speed and accuracy of response, were enhanced. Nevertheless, it was clear that performance could be further improved if closer attention was paid to integrating the system within the prevailing task environment. New displays should not only be physically integrated within existing consoles but the information provided by the system should be consistent with current control room display conventions and operating procedures. Experimentation is particularly valuable because it can reveal the behavioural consequences of inconsistency or lack of proper integration in prototype decision support systems. (author). 7 refs.

44298 (IAEA-TECDOC–529, pp. 147-155) **Decision support systems: Users, organization and design.** Otway, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre); Turner, B.; Haastrup, P. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331–: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

This paper reviews the features of decision support systems (DSSs), distinguishing them from other kinds of computer-based information systems. The design of an effective DSS requires consideration of not only the user's needs, characteristics and capabilities, but also a knowledge of the situation in which the user functions. It is misleading to consider the user as an individual, isolated from group influences, organisational culture and the larger social environment. The user must actively participate in the design of the DSS which must be tailored for each specific application. The design of the Ispra Risk Management Support System (IRIMS) is summarised as an example of this design philosophy. It was designed in consultation with a group of potential users and is currently being customized for a particular application in collaboration with the Netherlands Ministry for Housing, Physical Planning and the Environment. The lessons learnt from the IRIMS design process are summarised and their implications for the design of systems intended to aid process plant operators are discussed. (author). 15 refs.

44299 (IAEA-TECDOC–529, pp. 169-180) **Computerized monitoring systems: Design requirements for a better impact on plant operation.** Papin, B. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)); Beltranda, G. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331–: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

During the last decade, very quick improvement in computer science has made possible the on-line implementation of more and more complex systems aiming at the assistance of human operators for nuclear plant control and monitoring. It is a fact that most of these systems, although providing them with potentially useful information, are not very well accepted by the plant operators. The main reason of this fact is that these systems are designed on a 'designer view basis' instead of an 'operator view basis'. After a brief review of the potential impact of computerized operator aids, a tentative analysis of the possible reasons of rejection by operators and of the design requirements that should be respected to make these systems effectively useful, is presented. (author). 6 refs, 3 figs.

44300 (IAEA-TECDOC–529, pp. 193-202) **Design of decision support systems.** Wahlstroem, B. (Technical Research Centre of Finland, Espoo (Finland). Lab. of Electrical and Automation Engineering). International Atomic Energy Agency, Vienna (Austria).

Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The paper is addressing the design of decision support systems to be used in the nuclear industry and the requirements placed on such systems. A general model of the decision-making situation is proposed for the structuring of the different functions provided by the decision support system. The relative merits of different functions of the support systems and their practical implementation are discussed. A proposal for the functions to be included in a decision support system is given as a result fo the discussion. The practical design of decision support system is discussed, and some general remarks on the management of design projects are given. The use of decision support systems and their integration in the every day routines are also discussed. Reference is given to experiments, where a large scale validation of decision support systems have been attempted. One of the findings from the validation experiments, is that it might be difficult or even impossible to prove the benefit of a proposed design of a decision support system in quantitative terms. Present design practices are bringing in the concern for the human as a part of the system comparatively late and in a rather unsystematic way. As a conclusion it is argued that more effort should be spent in building up an understanding of the dynamics of design projects. Such an understanding can be used to create better models for carrying out the design projects and to specify different design tools to be used. (author). 17 refs, 1 fig, 5 tabs.

44301 (IAEA-TECDOC–529, pp. 103-113) **Requirements for and limitations on designing decision support systems.** Larichev, O.I. (USSR Academy of Sciences, Moscow (USSR). Inst. for Systems Studies); Petrovskij, A.B. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

Decision Support Systems (DSS), which combine the capabilities of modern computers and human skills in solving complex ill-structured problems of organizational management, has been created as an evolution and development of Decision Theory, Management Information Systems and Data Base Management Systems. The DSS help users to formulate and analyze decision alternatives in a number of ways by making use of objective and subjective data, models, knowledge. The main components of a conceptual DSS model are 'user-system' interface, block of problem analysis and structuring, decision-making block, data base, model base, and knowledge base. The 'user-system' interface contains facilities for generating and controlling the dialogue. The blocks of problem analysis and decision-making incorporate procedures and methods which help formulate the problem, analyze approaches to its solution, and generate the result by making use of the data, model and knowledge bases. The preliminary analysis and structuring of the problem are carried out either by the decision maker alone or jointly with a skilled consultant-analyst. The ability to conceive the structure of a problem correctly is an art reinforced by experience and intuition. The complexity of even a preliminary analysis, and the presence of numerous ill-defined factors, set a number of requirements to DSS. An effective decision-making depends on both the harmony of decision-maker and consultant efforts and the DSS capacities. Problems arising in designing each of DSS blocks and examples of its successful implementation are considered in paper. At the early stages of its development DSS was treated as a computer-based facility for assisting in processing huge amounts of data with rigidly assigned models and in presenting decision results. It was explicitly assumed that the problem solved was sufficiently clear and understandable. (Abstract Truncated)

44302 (IAEA-TECDOC–529, pp. 133-138) **Operator companion for CANDU reactors.** Lupton, L.R. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Shah, R.R. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331--: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

As CANDU nuclear power plants become more complex, and are operated under tighter constraints and for longer periods between outages, plant operations staff will have to absorb more information to correctly and rapidly respond to upsets. A development program is underway at Atomic Energy of Canada Limited to use expert systems and interactive media tools to assist operations staff of existing and future CANDU plants. The complete system for plant information access and display, on-line advice and diagnosis, and interactive operating procedures is called the Operator Companion. A prototype, consisting of operator consoles, expert systems and simulation modules in a distributed architecture, is currently being developed to demonstrate the concepts of the Operator Companion. (author). 5 refs, 2 figs.

44303 (IAEA-TECDOC–549) **Computer based aids for operator support in nuclear power plants.** International Atomic Energy Agency, Vienna (Austria). Apr 1990. 123p. Order Number DE90637043. Source: NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS.

In the framework of the Agency's programme on nuclear safety a survey was carried out based on a questionnaire to collect information on computer based aids for operator support in nuclear power plants in Member States. The intention was to put together a state-of-the-art report where different systems under development or already implemented would be described. This activity was also supported by an INSAG (International Nuclear Safety Advisory Group) recommendation. Two consultant's meetings were convened and their work is reflected in the two sections of the technical document. The first section, produced during the first meeting, is devoted to provide some general background material on the overall usability of Computerized Operator Decision Aids (CODAs), their advantages and shortcomings. During this first meeting, the first draft of the questionnaire was also produced. The second section presents the evaluation of the 40 questionnaires received from 11 Member States and comprises a short description of each system and some statistical and comparative observations. The ultimate goal of this activity was to inform Member States, particularly those who are considering implementation of a CODA, on the status of related developments elsewhere. 8 refs, 10 figs, 4 tabs.

2205 Environmental Aspects

Refer also to citation(s) 44314, 44328, 44359, 45275, 45325, 45581, 45583, 46200

44304 (PNL–7434) **The Hanford Site New Production Reactor (NPR) economic and demographic baseline forecasts.** Cluett, C. (Battelle Human Affairs Research Center, Seattle, WA (USA)); Clark, D.C.; Pittenger, D.B. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 40p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90016195. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this is to present baseline employment and population forecasts for Benton, Franklin, and Yakima Counties. These forecasts will be used in the socioeconomic analysis portion of the New Production Reactor Environmental Impact Statement. Aggregate population figures for the three counties in the study area were developed for high- and low-growth scenarios for the study period 1990 through 2040. Age-sex distributions for the three counties during the study period are also presented. The high and low scenarios were developed using high and low employment projections for the Hanford site. Hanford site employment figures were used as input for the HARC-REMI Economic and Demographic (HED) model to produced baseline employment forecasts for the

three counties. These results, in turn, provided input to an integrated three-county demographic model. This model, a fairly standard cohort-component model, formalizes the relationship between employment and migration by using migration to equilibrate differences in labor supply and demand. In the resulting population estimates, age-sex distributions for 1981 show the relatively large work force age groups in Benton County while Yakima County reflects higher proportions of the population in the retirement ages. The 2040 forecasts for all three counties reflect the age effects of relatively constant and low fertility increased longevity, as well as the cumulative effects of the migration assumptions in the model. By 2040 the baby boom population will be 75 years and older, contributing to the higher proportion of population in the upper end age group. The low scenario age composition effects are similar. 13 refs., 5 figs., 9 tabs.

44305 (SSI–90-08) **Emission of radionuclides to water recipients from swedish nuclear power plants and from Studsvik AB.** Melin, J.; Bondesson, A.; Elbe, M. National Inst. of Radiation Protection, Stockholm (Sweden). 16 Mar 1990. 36p. (In Swedish). Order Number DE90636805. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The emission of radionuclides to water recipients from Swedish power and research reactors are controlled and sampled by reactor operators. Control measurement have been performed by the Institute of Radiation Protection and are compared to the measurements of the reactor operators. The measuring methodologies are also described. (L.E.).

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 43915, 44241, 44252, 44320, 44322, 44323, 44326, 44330, 44339, 44345, 44361, 44363, 45133, 45170, 45908, 46049, 46267

44306 (CONF-9008136–1) **Irradiation research capabilities at HFIR [High Flux Isotope Reactor] and ANS [Advanced Neutron Source].** Thoms, K.R. Oak Ridge National Lab., TN (USA). [1990]. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on radiation effects on materials in high radiation environments; Salt Lake City, UT (USA); 13-15 Aug 1990. Order Number DE90016053. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A variety of materials irradiation facilities exist in the High Flux Isotope Reactor (HFIR) and are planned for the Advanced Neutron Source (ANS) reactor. In 1986 the HFIR Irradiation Facilities Improvement (HIFI) project began modifications to the HFIR which now permit the operation of two instrumented capsules in the target region and eight capsules of 46-mm OD in the RB region. Thus, it is now possible to perform instrumented irradiation experiments in the highest continuous flux of thermal neutrons available in the western world. The new RB facilities are now large enough to permit neutron spectral tailoring of experiments and the modified method of access to these facilities permit rotation of experiments thereby reducing fluence gradients in specimens. A summary of characteristics of irradiation facilities in HFIR is presented. The ANS is being designed to provide the highest thermal neutron flux for beam facilities in the world. Additional design goals include providing materials irradiation and transplutonium isotope production facilities as good, or better than, HFIR. The reference conceptual core design consists of two annular fuel elements positioned one above the other instead of concentrically as in the HFIR. A variety of materials irradiation facilities with unprecedented fluxes are being incorporated into the design of the ANS. These will include fast neutron irradiation facilities in the central hole of the upper fuel element, epithermal facilities surrounding the lower fuel element, and thermal facilities in the reflector tank. A summary of characteristics of irradiation facilities presently planned for the ANS is presented. 2 tabs.

44307 (ENEA-RT-VEL–89-04) **ENEA final results for the IRMA campaign: Intercomparison of reaction rate measurements at MASURCA.** Angelone, M.; Moioli, P. ENEA, Casaccia (Italy). Dipt. Reattori Veloci. Feb 1990. 48p. Order Number DE90514499. Source: NTIS (US Sales Only), PC A03/MF A01.

In November 1984, the international campaign, IRMA, for fission reaction rate and capture-to-fission ration measurements in fast reactor lattices was held at the Masurca zero power facility (CEA-Cadarache), under the auspices of NEACPR. Eight laboratories from seven countries (France, USA, Great Britain, Suisse, Belgium, Italy, FR Germany) participated in the IRMA campaign (Intercomparison of reaction Rate measurements at MAsurca). ENEA (Italian Commission for Alternative Energy Sources) took part in this international effort because the IRMA campaign represented an unique occasion to test, to validate and to improve the methods based on the Absolute Radiometric Technique, developed during the neutronic characterization of the TAPIRO reactor of ENEA-Casaccia Energy Research Centre (Italy), and to be used for the neutronic characterization of the PEC reactor. This technique requires the use of a well calibrated Ge detector, and knowledge of some nuclear data such as the fission yields, the gamma ray transition probabilities, etc. In this paper, after summarizing relevant details concerning the Masurca facility arrangement for the IRMA campaing and the ENEA experimental methods, the final results obtained by ENEA are reported and compared to those of the other participants. The ENEA results agree, within experimental uncertainties, with the mean values obtained using the results produced by all the partecipants.

44308 (EUR–12195) **The Phebus FP project.** Delchambre, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Inst. de Protection et de Surete Nucleaire); Von der Hardt, P. Commission of the European Communities, Luxembourg (Luxembourg). 1989. 127p. Contract 3428-88-07-TP-ISP-F. Source: NTIS (US Sales Only), PC A07/MF A01.

This report summarizes the pre-project studies concerning the PHEBUS FP facility. After recalling the programme objectives, it describes the projected modifications to the PHEBUS reactor, outlines new installations and justifies the selected options.

44309 (IAEA-TECDOC–641, pp. 281) **Slowpoke heating reactor: Technical and economic review.** Hilborn, J.W. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487–: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

Since global energy requirements are expected to double over the next 40 years, nuclear heating could become as important as nuclear electricity generation. To fill that need, AECL has designed a 10 MW nuclear heating plant for large buildings. Production hot water at temperatures below 100 deg. C, it incorporates a small pool-type reactor based on the successful slowpoke research reactor. A 2MW prototype is now being tested at the Whiteshell Nuclear Research Establishment in Manitoba, and the design of a 10 MW commercial unit is well advanced. With capital costs in the range 5 million dollars to 7 million dollars, unit energy costs could be as low as 0.02 dollars per KWh, for a unit operating at 50 % load factor over a 25-year period. By keeping the reactor power low and the water temperature below 100 deg. C, much of the complexity of the large nuclear power plants can be avoided, thus allowing these small, safe, nuclear heating systems to be economically viable. If we can achieve our immediate goal of licensing and gaining public acceptance for a low-power, unpressurized heating reactor, in an urban environment, an important precedent will be established for the future installation of more advanced commercial reactors, for electricity generation and other applications. Conversely, if a small, simple reactor cannot be licensed or cannot gain public acceptance, detailed technical and economic studies of more advanced concepts are irrelevant. (author).

44310 (JAERI-M–90-034) **Outlines and verifications of the codes used in the safety analysis of High Temperature Engineering Test Reactor (HTTR).** Shiina, Yasuaki (Japan Atomic

Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Kunitomi, Kazuhiko; Maruyama, Soh; Fujita, Shigeki; Nakagawa, Shigeaki; Iyoku, Tatsuo; Shindoh, Masami; Sudo, Yukio; Hirano, Masashi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 109p. (In Japanese). Order Number DE90513755. Source: NTIS (US Sales Only), PC A06/MF A01.

This paper presents brief description of the computer codes used in the safety analysis of High Temperature Engineering Test Reactor. The list of the codes is: 1. BLOOST-J2 2. THYDE-HTGR 3. TAC-NC 4. RATSAM6 5. COMPARE-MOD1 6. GRACE 7. OXIDE-3F 8. FLOWNET/TRUMP. Of described above, 1, 3, 4, 5, 6 and 7 were developed for the multi-hole type gas cooled reactor and improved for HTTR and 2 was originated by THYDE-codes which were developed to treat the transient thermo-hydraulics during LOCA of LWR. Each code adopted the models and properties which yield conservative analytical results. Adequacy of each code was verified by the comparison with the experimental results and/or the analytical results obtained from the other codes which were already proven. (author).

44311 (JAERI-M–90-042) **Experimental study on reactivity worth in high conversion light water reactor using FCA-HCLWR cores.** Okajima, Shigeaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sakurai, Takeshi; Osugi, Toshitaka; Oigawa, Hiroyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 59p. (In Japanese). Order Number DE90513746. Source: NTIS (US Sales Only), PC A04/MF A01.

Experimental study on reactivity worth in HCLWR cores has been carried out in a series of experiments using the Fast Critical Assembly (FCA) in JAERI. Both central reactivity worths for nuclear fuel materials as well as absorber materials and simulated control rod worth were measured in FCA-HCLWR cores fueled with enriched uranium (Phase-1 experiment) and fueled with plutonium (Phase-2 experiment). The experimental values are compared with the calculated ones which obtained from JENDL-2 data and the SRAC system. The calculation for the central reactivity worth of the nuclear fuel materials underestimated the measured values by 20-25 % in Phase-1 experiment and by 0-20 % in Phase-2 experiment. For the absorber materials, the calculation also gave the underestimation in both Phase-1 and Phase-2 experiments. The ratios between calculated and measured values (C/E values) in Phase-2 experiment were closer to unity than those in Phase-1 experiment. The dependence of ^{10}B content in C/E values was not found through all cores. The C/E values did not show the spectral dependence in Phase-1 experiment, on the other hand, showed it in Phase-2 experiment. For the hafnium sample, the C/E values were smaller than those for B_4C sample in both Phase-1 and Phase-2 experiments. The spectral dependence was not found in all cores. For the simulated control rod worth, the calculation gave underestimation in Phase-1 and Phase-2 experiments. The C/E values were closer to unity than those of the central reactivity worths of absorber materials. The C/E values in Phase-1 experiment approached to unity with softening neutron spectrum, while those in Phase-2 experiment left away from unity in the order XV-2(45V), XV-2(95V), XV-1 cores. This tendency was also found in the central reactivity worth of absorber materials. For the hafnium rod, the C/E values were smaller that those of B_4C rods. (author).

44312 (JAERI-M–90-052) **Measurement of reaction rates in FCA XIV-cores simulating high conversion light water reactor.** Obu, Makoto (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nemoto, Tatsuo; Sakurai, Takeshi; Iijima, Susumu; Osugi, Toshitaka; Tahara, Yoshihisa. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 58p. (In Japanese). Order Number DE90513797. Source: NTIS (US Sales Only), PC A04/MF A01.

Measurements of reaction rates have been performed in three uranium-fueled cores of the FCA constructed for 'Phase-1 experiment' on a high conversion light water reactor (HCLWR). These cores possess central test zones of different fuel enrichments and moderator to fuel volume ratios. Radial and axial fission rates of ^{235}U, ^{239}Pu, ^{238}U and ^{237}Np were measured in each test zone by means of the micro-fission counter traverse. A region where the fundamental mode spectrum is established in the test zone were determined by utilizing these fission rate distributions. Central reaction rate ratios relative to the ^{235}U fission rate were obtained from the measurements by the micro-fission counters and metallic uranium foils to examine in the reaction rate ratios among the three cores. The measured data were analyzed by the SRAC code system with the nuclear data file JENDL-2. The results of reaction rate ratios show that the calculations overpredict the experimental values of the ^{238}U capture /^{235}U fission and ^{238}U fission /^{235}U fission rate ratios in the three cores. (author).

44313 **Evolution of the liquid metal reactor: The integral fast reactor (IFR) concept.** Till, C.E. (Argonne National Lab., IL (USA)); Chang, Y.I. *Proceedings of the American Power Conference (USA),* 51: 688-691 (1989). (CONF-890425–: American power conference, Chicago, IL (USA), 24-26 Apr 1989).

This paper reports on the integral fat reactor (IFR) concept. A key feature of the IFR concept is the metallic fuel, the original choice in liquid metal reactor development. An IFR development program is detailed by the authors.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 43998, 44235, 44304, 44324, 44332, 44349, 44352, 44354, 45908, 46059

44314 (GAO/RCED–89-212) **Policy implications of funding DOE's K Reactor Cooling tower Project: Nuclear health and safety.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 21p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report has reviewed the construction of a cooling tower for the K reactor at the DOE Savannah River Site in Aiken, South Carolina. It has been found that the cooling tower would prevent further destruction of cypress and tupelo trees, would maintain a more consistent flow from site streams, and would allow earlier recovery of stream corridors inside a portion of the site. About 630 acres of wetlands have already been affected by the hot water discharged by the K reactor during the past 35 years. GAO believes that about 10 to 12 acres of additional damage would be prevented by the tower for every year the reactor is operated, and if current plans for re-start and retirement of the reactor are followed, less than 100 acres would be preserved. As requested, GAO also identified an example of a project that could be funded as compensation to the public for the damage the K reactor would do if Congress exempted it from the Clean Water Act and allowed it to continue to operate with a cooling tower.

2209 Reactor Safety

Refer also to citation(s) 44215, 44234, 44248, 44259, 44288, 44289, 44290, 44296, 44297, 44424, 44433, 44964, 44992, 45257, 45611, 46051

44315 (AD-A–221513/5/XAB) **Analysis of decommissioning costs for the AFRRI TRIGA reactor facility. Technical report.** Forsbacka, M.; Moore, M. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). Dec 1989. 16p. (AFRRI-TR–89-2). Source: NTIS, PC A03/MF A01.

This report provides a cost analysis for decommissioning the Armed Forces Radiobiology Research Institute (AFRRI) TRIGA reactor facility. AFRRI is not suggesting that the AFRRI TRIGA reactor facility be decommissioned. This report was prepared in compliance with paragraph 50.33 of Title 10, Code of Federal Regulations, which requires that funding for the decommissioning of reactor facilities be available when licensed activities cease. The planned method of decommissioning is complete decontamination (DECON) of the AFRRI TRIGA reactor site to allow for restoration of the site to full public access. The cost of DECON in 1990 dollars is estimated to be $3,200,000. The anticipated ancillary costs of facility site demobilization and spent fuel shipment will be an additional $600,000. Thus, the total cost of terminating reactor operations at AFRRI will be about $3,800,000. The primary basis for developing this cost estimate was a study of the decommissioning

costs of similar reactor facility performed by Battelle Pacific Northwest Laboratory, as provided in U.S. Nuclear Regulatory Commission publication NUREG/CR-1756. The data in this study were adapted to reflect the decommissioning requirements of the AFRRI TRIGA reactor facility.

44316 (BF-R–40.039-2.5) **Investigation of fission product retention by the HTR reactor protection building by the vented confinement concept.** Fischer, K. Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Sep 1989. 42p. (In German). Contract BMFT 03 BT/2010. Source: Copy held by UB/TIB Hannover.

This report gives a survey of the physical models and correlations, which are suitable for modelling aerosol filters of current types in the context of thermo-gas dynamics programs. Two basic types of filter apparatus are considered: fibre filters and particle bed filters. The phenomena to be modelled are: separation behaviour, flow resistance (pressure drop) and service life (clogging of the filter). The theoretical attempts at modelling filters generally start from the phenomena on the single collector. The modelling of an actual filter as a collection of many individual collectors does not show satisfactory agreement with experimental findings in all cases with the available models. A reasoned selection of models or correlations is made, which are suitable to model aerosol filters realistically in the context of the FATHOMS-MAEROS aerosol thermodynamics program. (orig.).

44317 (BF-R–40.039-7-TN) **Determination of temperatures and heat transfer in the reactor building after failure of the reactor cell cooling system.** Geiss, M.; Holzbauer, H.; Schimetschka, E. Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.). Aug 1989. 20p. (In German). Contract BMFT 03 BT/2010. Source: Copy held by UB/TIB Hannover.

The finite-element analyses of the conditions of afterheat removal in the case of a core heat-up accident brought the following essential results: Due to the large thermal capacities in the system, it takes about 200 days until steady-state conditions are reached with temperatures remaining stable. Separate analyses of afterheat removal conditions and core heat-up processes do not make sense in physical terms. The ventilation conditions in the reactor building have an important effect on the heat flow balances and maximum temperatures. Radiative heat transfer plays a decisive role in heat transfer. It must be assumed that the temperatures at the outer wall of the primary cell will remain between 130 and 150deg C for a prolonged period. (orig.).

44318 (BMU–1989-235) **Organization of radiation protection in German nuclear power stations.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.). Aug 1989. 164p. (In German). Contract BMU St.Sch. 1092. Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

Using the operating handbooks of the nuclear power stations in West Germany, an examination was carried out of how far the existing organisational structure for radiation protection fulfils the requirements for protection and whether a standardisation of the organisation would provide improvements for the protection of the personnel and for the practicability of the radiation protection organisation. In particular, the parts 'Personnel operating organisation', 'Radiation protection order' and 'Maintenance order' of the operating handbook were evaluated and an audit was made of the radiation protection organisation. In general, the result of the assessment is that the organisation of radiation protection does not contradict the orders, guidelines and regulations in any of the nuclear power stations examined. Corresponding to the possibilities of regulating details of the radiation protection organisation within the undertaking, the target of 'protection of the personnel against radioactive irradiation' is achieved by the various organisation structures which are largely equal to the given example. (orig./HP).

44319 (BMU–1990-252) **Aims and procedures used for the evaluation of research results in the field of nuclear safety with regard to the application of the Atomic Energy Law. Vol. 3.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Baumgaertel, K. Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.). Jul 1989. 456p. (In German). Contract BMU SR 419. (GRS-A–1615). Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The content of this report is a collection of research projects and investigations in the field of nuclear safety evaluated in 1987 and 1988. In addition the report gives an overview on objectives and procedures used for the evaluation. The purpose of this project, being executed for the Federal Ministry for the Environment, Natural Conservation and Nuclear Safety of the German Federal Republic is to inform all parties involved in the licensing procedure as well as the consulting councils on the newest nuclear safety research results and the status of their verification in a precise short manner. In addition experts opinions are given with regard to the relevance of these research results to nuclear rules and guidelines as well as to the execution of the Atomic Law. The informations are given by precise and short evaluations of final research reports or technical reports. These evaluations are executed by specialists who are acquainted with the technical aspects of the licensing procedure of nuclear power plants in the German Federal Republic. (orig.).

44320 (BNL–44836) **Counter-current flow limitation in thin rectangular channels.** Cheng, Lap Y. Brookhaven National Lab., Upton, NY (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900917–14: American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities, Boise, ID (USA), 30 Sep - 3 oct 1990). Order Number DE90015124. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The phenomenon of counter-current flow limitation (CCFL) in thin rectangular channels is important in determining the heat removal capability of research reactors which use plate-type fuel elements similar to the MTR design. An analytical expression for predicting CCFL in narrow rectangular channels was derived from the momentum equations for the liquid and gas phase. The model assumes that the liquid downflow is in the form of a film along the narrower side walls of the channel, while the gas flow occupies the wide span of the rectangular channel. The average thickness of liquid film is related to the rate of gas flow through a stability criterion for the liquid film. The CCFL correlation agrees with air/water data taken at relatively high gas velocities. Depending on the magnitude of the dimensionless channel width W^*, the new CCFL correlation approaches zero liquid penetration either in the form of a Wallis correlation or in terms of a Kutateladze number. The new correlation indicates that for a thin rectangular channel, the constant C in the Wallis flooding correlation depends on the aspect ratio of the channel. The approach to the appropriate asymptotic solutions also justifies the use of twice the wide span as the correct length scale for thin rectangular channels. 14 refs., 6 figs.

44321 (BNL-NUREG–44849) **Influence of organizational factors on safety.** Haber, S.B.; Metlay, D.S.; Crouch, D.A. Brookhaven National Lab., Upton, NY (USA). [1990]. 5p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-9010155–2: Human factors society conference, Orlando, FL (USA), 8-12 Oct 1990). Order Number DE90015127. Source: NTIS, PC A02/MF A01; OSTI; INIS.

There is a need for a better understanding of exactly how organizational management factors at a nuclear power plant (NPP) affect plant safety performance, either directly or indirectly, and how these factors might be observed, measured, and evaluated. The purpose of this research project is to respond to that need by developing a general methodology for characterizing these organizational and management factors, systematically collecting information on their status and integrating that information into various types of evaluative activities. Research to date has included the development of the Nuclear Organization and Management Analysis Concept (NOMAC) of a NPP, the identification of key organizational and management factors, and the identification of the methods for systematically measuring and analyzing the influence of these factors

on performance. Most recently, two field studies, one at a fossil fuel plant and the other at a NPP, were conducted using the developed methodology. Results are presented from both studies highlighting the acceptability, practicality, and usefulness of the methods used to assess the influence of various organizational and management factors including culture, communication, decision-making, standardization, and oversight. 6 refs., 3 figs., 1 tab.

44322 (CONF-900917–15) **Status of High Flux Isotope Reactor (HFIR) post-restart safety analysis and documentation upgrades.** Cook, D.H.; Radcliff, T.D.; Rothrock, R.B.; Schreiber, R.E. Oak Ridge National Lab., TN (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities; Boise, ID (USA); 30 Sep - 3 oct 1990. Order Number DE90015605. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The High Flux Isotope Reactor (HFIR), an experimental reactor located at the Oak Ridge National Laboratory (ORNL) and operated for the US Department of Energy by Martin Marietta Energy Systems, was shut down in November, 1986 after the discovery of unexpected neutron embrittlement of the reactor vessel. The reactor was restarted in April, 1989, following an extensive review by DOE and ORNL of the HFIR design, safety, operation, maintenance and management, and the implementation of several upgrades to HFIR safety-related hardware, analyses, documents and procedures. This included establishing new operating conditions to provide added margin against pressure vessel failure, as well as the addition, or upgrading, of specific safety-related hardware. This paper summarizes the status of some of the follow-on (post-restart) activities which are currently in progress, and which will result in a comprehensive set of safety analyses and documentation for the HFIR, comparable with current practice in commercial nuclear power plants. 8 refs.

44323 (CONF-9009219–2) **Modeling Advanced Neutron Source reactor station blackout accident using RELAP5.** Chen, N.C.J. (Oak Ridge National Lab., TN (USA)); Fletcher, C.D. Oak Ridge National Lab., TN (USA). [1990]. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From 1990 joint RELAP5 and TRAC-BWR international user seminar; Chicago, IL (USA); 17-21 Sep 1990. Order Number DE90015792. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Advanced Neutron Source (ANS) system model using RELAP5 has been developed to perform loss-of-coolant accident (LOCA) and non-LOCA transients as safety-related input for early design considerations. The transients studies include LOCA, station blackout, and reactivity insertion accidents. The small-, medium-, and large-break LOCA results were presented and documented. This paper will focus on the station blackout scenario. The station blackout analyses have concentrated on thermal-hydraulic system response with and without accumulators. Five transient calculations were performed to characterize system performance using various numbers and sizes of accumulators at several key sites. The main findings will be discussed with recommendations for conceptual design considerations. ANS is a state-of-the-art research reactor to be built and operated at high heat flux, high mass flux, and high coolant subcooling. To accommodate these features, three ANS-specific changes were made in the RELAP5 code by adding: the Petukhov heat transfer correlation for single-phase forced convection in the thin coolant channel; the Gambill additive method with the Weatherhead wall superheat for the critical heat flux; and the Griffith drift flux model for the interfacial drag in the slug flow regime. 7 refs., 6 figs., 1 tab.

44324 (CONF-9010151–1) **Large break loss of coolant severe accident sequences at the HFIR [High Flux Isotope Reactor].** Simpson, D.B.; Greene, S.R. Oak Ridge National Lab., TN (USA). [1990]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International topical meeting on the safety, status, and future of non-commercial reactors and irradiation facilities; Boise, ID (USA); 4 Oct 1990. Order Number DE90014205. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An assessment of many potential HFIR severe accident phenomena was conducted during the HFIR design effort, and many severe accident mitigating features were designed into the plant. These evaluation typically incorporated a "bounding" or highly conservative analysis approach and employed tools and techniques representative of the state of knowledge in the mid-1960s. Recently, programs to address severe accident issues were initiated at the Oak Ridge National Laboratory (ORNL) to support the HFIR probabilistic risk assessment (PRA) and equipment qualification and accident management studies. This paper presents the results of environment condition calculations conducted to evaluate a response of HFIR's heat exchanger cell environment to a double-ended rupture of a 0.25 m diameter coolant loop downstream of the circulating pump and check valve. The confinement calculations were performed using an atmospheric fission product source for the heat exchanger cell consistent with, but more conservative than that stipulated in Regulatory Guide 1.89. The results of the calculations indicate that the heat exchanger cell atmospheric temperature peaks at 377 K 225 seconds into the transient and then begins decreasing at approximately 1.7 K per minute. 8 refs., 5 figs.

44325 (EGG–2583) **Idaho National Engineering Laboratory (INEL) technical review of YGN 3 and 4 thermal-hydraulic relative size effects.** Ward, L.W.; Fineman, C.P.; Gruen, G.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 144p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015419. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

Combustion Engineering, Inc., (CE) and the Korean Advanced Energy Research Institute (KAERI) are jointly designing two 2825 MW_t System 80 nuclear steam supply systems for construction in Korea. The two 2825 MW_t plants are similar in design to the larger System 80 class of plants but are reduced in size from 3817 MW_t. These plants will be operated by the Korean Electric Power Company and have been designated as Yonggwang Nuclear Units 3 and 4. The Idaho National Engineering Laboratory (INEL) was selected by CE to perform a third party independent technical review of the thermal-hydraulic safety analyses for Yonggwang Units 3 and 4. The purpose of the review is to establish the acceptability of the safety analyses addressing the differences in size between the 2825 and 3817 MW_t CE designed System 80 plants. The analysis methods used by Combustion Engineering, Inc. were also reviewed to assure that only United States Nuclear Regulatory Commission approved methods were used for the Yonggwang Units 3 and 4 safety analyses and that the methods were applied in a manner consistent with that for the Palo Verde System 80 plants, currently in operation in the US. In general, it was found that the differences between 3817 and 2825 MW_t units led to increased margins except for the large break LOCA (LBLOCA) and boron dilution transient. For the LBLOCA, use of improved models enhanced performance which allowed an increase in peak linear heat generation rate relative to that for the 3817 MW_t plant. For the boron dilution event, an increase in the shutdown margin was necessary to assure the same time to criticality as that for the 3817 MW_t plant. 39 refs., 9 figs., 4 tabs.

44326 (EGG-EAST–8700) **Analysis of loss-of-coolant accidents in the advanced neutron source reactor.** Fletcher, C.D.; Ghan, L.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1990. 183p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015413. Source: NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

The RELAP5 computer code and a model of the Advanced Neutron Source (ANS) were used to simulate system response to hypothetical loss-of-coolant accidents (LOCAs). The computer code was modified to represent the thermal-hydraulic phenomena expected within the ANS reactor core. The ANS model is biased on the final preconceptual ANS design; the ANS is currently in the conceptual design development stage. This effort represents a first detailed study of ANS transient system response during accidents. The RELAP5 computer code, its modifications, and the ANS system model are described. Analyses of simulations for large, medium, and small break LOCAs in various main coolant pipe locations and for a pressurizing line break are presented. The results indicate that fuel damage is experienced in the ANS preconceptual design for the medium and large break LOCAs. The effectiveness of employing a gas-charged accumulator on the primary coolant

system to prevent core damage is investigated with sensitivity calculations. These investigations indicate that fuel damage is prevented for the medium breaks (but not for the large breaks) if a 10-m^3 nitrogen-charged accumulator is used on the hot leg. Analysis uncertainties are addressed and recommendations for reducing them are advanced. 14 refs., 117 figs., 13 tabs.

44327 (EPRI-NP-6942-D) **Foreign approaches to controlling radiation-field buildup in BWRs.** Lin, C.C. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Electric Power Research Inst., Palo Alto, CA (USA); General Electric Co., San Jose, CA (USA). Nuclear Energy Div. ©Aug 1990. 88p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The technologies of controlling the radiation field buildup in foreign BWRs have been thoroughly reviewed. In both Japan and Sweden, the radiation field buildup control program includes three major elements: (1) removal of cobalt sources and limitation of cobalt content of in-core components, (2) reduction of corrosion product input, and (3) improvement of water quality. The main objectives of the developed technologies are: to reduce activity production; to minimize the release of activities from the fuel deposits and in-core components to the coolant; and to minimize the activity deposition from the coolant to the out-of-core surfaces. In this report, the historical background of Japanese experience and technology development in radiation reduction have been reviewed. The major counter-measures to reduce and control the radiation field buildup in the "old" and "new" plants are discussed in detail. Evaluation of the applicability and potential of using foreign radiation field control technologies in US BWRs is also presented. 38 refs., 41 figs., 12 tabs.

44328 (ETDE-IT-90-09) **ENEA activities on seismic isolation of nuclear and non-nuclear structures.** Martelli, A.; Masoni, P.; Forni, M.; Indirli, M.; Spadoni, B.; Di Pasquale, G.; Lucarelli, V.; Sano', T.; Bonacina, G.; Castoldi, A. ENEA, Bologna (Italy); ENEA, Rome (Italy). Direzione Sicurezza Nucleare e Protezione Sanitaria; Istituto Sperimentale Modelli e Strutture SpA (ISMES), Bergamo (Italy). Aug 1989. 16p. (CONF-8908221-1: 1. international seminar on seismic base isolation for nuclear power facilities, San Francisco, CA (USA), 21-22 Aug 1989). Order Number DE90514463. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 1st international seminar on seismic base isolation of nuclear power facilities (San Francisco, 21-22 Aug 1989).

Work on the anti-seismic design of nuclear and non-nuclear structures was started by ENEA (Italian Commission for Alternative Energy Sources), in cooperation with ISMES Spa, in 1986. The first activity consists in a proposal for guidelines for seismically isolated nuclear plants using high damping, steel-laminated elastomer bearings. This is being performed within the framework of an agreement with the General Electric Company. Furthermore, R&D work has been defined and recently initiated to support the development of the seismic isolation guidelines, as well as that of qualification procedures for seismic isolation systems in general. The present R&D work includes static and dynamic experiments on single bearings, shake table tests with multi-axial simultaneous excitations on reduced-scale mock-up of isolated structures supported by multiple bearings, and dynamic tests on large-scale isolated structures with on-site test techniques. It also includes the development and validation of finite-element non-linearmodels of the single bearings, as well those of simplified design tools for the analysis of the isolated structures dynamic behaviour. Extension of this work is foreseen in a wider national frame.

44329 (ETDE-IT-90-42) **An improved method for the LMR core seismic analysis and comparison with the usual design approaches.** Forni, M.; Indirli, M.; Martelli, A.; Orsi, R. ENEA, Bologna (Italy). Dipt. Reattori Veloci. Apr 1989. 21p. (CONF-890417-2: INFO '89, New Orleans, LA (USA), 16-19 Apr 1989). Order Number DE90514517. Source: NTIS (US Sales Only), PC A03.

Paper presented at the international topical meeting on pressure vessel and nuclear codes and standards (Seoul, 19-21 Apr 1989).

Seismic design analysis of liquid metal reactor cores is usually performed taking into account the non-linear effects of shocks occurring among the core elements and the vessel-core mechanical coupling. Up to now, however, the dynamic runs have usually been carried out using one-dimensional codes and mainly limiting the analysis to the core diameters. Furthermore, simplified approaches have been adopted to account for fluid effects: these neglect the non-diagonal added mass effects. After summarizing the main features of the usual design procedures, this paper presents an improved methodology, which takes into account the effects of fluid coupling between vessel and core and those related to both the two-directional nature of core horizontal excitation and the two-dimensional features of core response. To provide an example, the results obtained by applying this methodoly to the PEC reactor core are compared to those determined in the design analysis in the case of safe-shutdown-earthquakes.

44330 (ETDE-IT-90-45) **Core void reactivity reduction in a BLW/HW experimental reactor (Cirene, Latina, Italy).** Cannata, G.; Chow, H.C.; Lopez, S.; Martinelli, R. ENEA, Rome (Italy). May 1989. 24p. (CONF-890555-25: 7. power plant dynamics, control and testing symposium, Knoxville, TN (USA), 15-17 May 1989). Order Number DE90514520. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 7th power dynamics control and testing symposium (Knoxville, 15-17 May 1989).

The method, developed for the reduction of coolant void reactivity in light water cooled, heavy water moderated reactors, involves the exploitation of neutronic effects on voiding such as changes in flux level and spectrum in the fuel to produce, by the judicious addition of specific neutron absorbers, a negative reactivity component on voiding. The method was applied to CIRENE, an Italian designed experimental plant whose licensing process is adversely affected by the presence of a large positive void reactivity feedback. The feasibility of reducing void reactivity to virtually zero without changing the structural characteristics of the fuel elements is demonstrated. Safety-related implications of the modified design are also reviewed by means of a preliminary analysis of the control system response and of the plant behaviour in selected hypothetical severe accidents. It is recognized that the modified bundle design, while still open to improvements and optimization, is adequate to solve the main problems that hinder the acceptance of the present CIRENE core design.

44331 (GAO/RCED-90-47) **DOE'S award fees at Rocky Flats do not adequately reflect ES and H problems: Nuclear health and safety.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 33p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

Despite the persistance of significant environmental, safety, and health problems at the Rocky Flats plant, it's contractor has received substantial monetary awards from the Department of Energy for operating the plant. During fiscal years 1986 through 1988, approximately $26.8 million was received in award fees - about 84 percent of the total award fees that were available under the contract with DOE. This report identified a number of problems that raise concerns about how the award process is being administered: significant ES and H deficiencies have been downplayed in the evaluation process; the process has placed more emphasis on production rather than on ES and H performance; and the evaluations have not been reviewed by DOE headquarters organizations that have important roles in the conduct of activities. This report recommends that DOE restructure its award fee process to provide a clear understanding to its contractors what they will be losing in award fees for certain types of ES and H problems.

44332 (GAO/RCED-90-61FS) **Information on a quality assurance problem at DOE's Savannah River site: Nuclear health and safety.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 15p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses DOE's Savannah River Site, the only source of tritium production, an important material used in nuclear weapons. In September 1988, DOE's Savannah River contractor

reported that some of the fuel and targets used to make tritium did not have the correct material content for where they were to be placed in the reactor or their material content could not be determined - problems that could affect safe reactor operations. It was found that inadequate quality assurance procedures both at the manufacturing facility and at the reactor area caused the problems. According to both DOE and contractor officials, no safety problems resulted from the fuel and target tube problems. DOE approved a new quality assurance program developed by the contractor to address the problem. The Secretary of Energy has acknowledged these past problems and has begun to make changes within DOE to strengthen the department's ability to manage its contractors and make safety a first priority.

44333 (GRS-F–183) **List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: January 1 to March 31, 1990.** Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.). May 1990. 59p. (In German). Order Number DE90517360. Source: NTIS (US Sales Only), PC A04/MF A01.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning single problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programme of the BMFT, reporting organization. The list of reports appears quarterly. (orig.).

44334 (JAERI-M–90-035) **Evaluation report on SCTF Core-III tests S3-7 and S3-8: Investigation of tie plate water temperature distribution effects on water break-through and core cooling during reflooding in PWRs with combined-injection-type ECCS.** Okubo, Tsutomu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iguchi, Tadashi; Iwamura, Takamichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 152p. Order Number DE90513743. Source: NTIS (US Sales Only), PC A08/MF A01.

It has been said that the Emergency Core Cooling (ECC) water injected into the hot legs flows into the upper plenum and then falls back to the core (i.e. break-through) during reflood phase in a German type Pressurized Water Reactor (GPWR) with the combined-injection-type ECCS, and that the break-through occurs where the water temperature at the tie plate area is lower and subcooled. Based on this information two tests were conducted with the Slab Core Test Facility (SCTF) Core-III in order to investigate the effects of the water temperature distribution at the tie plate area on the break-through and the core cooling. In these tests, the subcooled ECC water was injected just above the Upper Core Support Plate (UCSP) in order to establish the desired water temperature distribution at the tie plate area. In one test (Test S3-7) the ECC water injection above the UCSP was performed above Bundles 3 and 4, and in the other test (Test S3-8) above Bundles 7 and 8 during initial 60 s a and then was changed to above Bundles 3 and 4. The test data were compared with those of Test S3-SH1, in which the injection was performed above Bundles 7 and 8 and the other test conditions were the same as in Tests S3-7 and S3-8. Analyzing these test data, the following has been found: The break-through occurs where the water temperature at the tie plate area is subcooled and the core cooling is enhanced significantly in the break-through region. The break-through location changes, with some time lag, following the change of the water temperature distribution at the tie plate area. Furthermore, the core cooling in the non-break-through regions is almost the same regardless of the location of the break-through. (author).

44335 (JAERI-M–90-046) **Evaluation report on SCTF Core-III test S3-9: Investigation of CCTF coupling test results under an evaluation model condition in PWRs with cold-leg-injection-type ECCS.** Okubo, Tsutomu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Iguchi, Tadashi; Iwamura, Takamichi; Akimoto, Hajime; Ohnuki, Akira; Abe, Yutaka; Adachi, Hiromichi; Murao, Yoshio; Sakaki, Isao. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 122p. Order Number DE90513747. Source: NTIS (US Sales Only), PC A06/MF A01.

In order to obtain the data of the reflooding behavior in a wide core under an Evaluation Model (EM) condition for a Pressurized Water Reactor (PWR) with a cold-leg-injection-type Emergency Core Cooling System (ECCS), a test was performed with the Slab Core Test Facility (SCTF) Core-III, which has the same radial width as the radius of a 1,000 MWe class PWR. The test was named Test S3-9. Major core initial and boundary conditions for the test were determined based on the test results of Cylindrical Core Test Facility (CCTF) Test C2-4, which is the base case test for the CCTF test series and was performed under an EM condition for a PWR with a cold-leg-injection-type ECCS. Therefore, the present test is also a coupling test between the SCTF and the CCTF under an EM condition. In the present report, the difference in the reflooding behavior between the SCTF and the CCTF is mainly investigated by comparing the experimental data from those two tests. Major conclusions obtained are as in the following: (1) Test S3-9 was successfully completed under an EM condition. Tie plate mass flow rate data were obtained and can be used for an experimental coupling with the UPTF. (2) The overall core cooling behavior observed in Test S3-9 was nearly the same as that observed in CCTF Test C2-4. (3) However, the core differential pressure characteristic observed in Test S3-9 was somewhat different from that observed in Test C2-4. Main reasons for the difference are almost explained to be different core inlet water subcooling between the two tests and the different effective core flow area between two facilities. (4) The core two-dimensional behavior observed in Test S3-9 had the same characteristic as observed in the other tests with the SCTF Core-II. (J.P.N.).

44336 (JAERI-M–90-050) **Development of leak analysis programs from through-wall-crack.** Shinokawa, Hidetoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Shibata, Katsuyuki; Isozaki, Toshikuni. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 118p. (In Japanese). Order Number DE90513760. Source: NTIS (US Sales Only), PC A06/MF A01.

To introduce Leak-Before-Break (LBB) concept into the piping design standard of the LWR pressure boundary piping, LBB research programs are actively conducted in many nuclear electricity countries. It is one of the most important items to evaluate leak rate through the pipe wall crack to shut down a nuclear power plant safely. At JAERI, a test on the leak rate from a cracked pipe under BWR or PWR operating condition has been carried out from 1987 till 1989. This test is planned to measure the leak flow through circumferential fatigue cracks in 4-, 6-and, 12-inch diameter pipes and through slit specimens. On the other hands, it is necessary to predict and analyse the leak flow through a crack for applying the result of the tests to the structural design standard including the LBB concept. This report describes the some computer programs that calculate crack-opening-area, the crack length, and the flow rate through SCC or fatigue cracks. In these programs, a crack-opening-displacement calculation is available based on modified Tada-Paris equation when pipe geometries and pipe stress conditions are given. The leakage rate calculation is based on Henry's homogeneous nonequilibrium critical flow model and Moody's slip model with several modifications to account for friction and fluid conditions. (author).

44337 (JAERI-M–90-051) **Effects of high temperature ECC injection on small and large break BWR LOCA simulation tests in ROSA-III program (RUNs 940 and 941).** Suzuki, Mitsuhiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakamura, Hideo; Kumamaru, Hiroshige; Anoda, Yoshinari; Yonomoto, Taisuke; Murata, Hideo; Tasaka, Kanji. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 269p. Order Number DE90513796. Source: NTIS (US Sales Only), PC A12/MF A01.

The ROSA-III program, of which principal results are summarized in a report of JAERI 1307, conducted small and large-break loss-of-coolant experiments (RUNs 940 and 941) with high water temperature of the emergency core cooling system (ECCS) are one

of the parametric study with respect to the ECCS effect on core cooling. This report presents all the experiment results of these two tests and describes additional finding with respect to the hot ECC effects on core cooling phenomena. By comparing these two tests (water temperature of 393 K) with the standard ECC tests of RUNs 922 and 926 (water temperature of 313 K), it was found that the ECC subcooling variation had a small influence on the core cooling phenomena in 5 % small break tests but had larger influence on them in 200 % break tests. The ECC subcooling effects described in the previous report are reviewed and the temperature distribution in the pressure vessel is investigated for these four tests. (author).

44338 (JAERI-M–90-053) **Developmental assessment of RELAP5/MOD3 code against ROSA-IV/TPTF horizontal two-phase flow experiments.** Kukita, Yutaka (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Asaka, Hideaki; Anoda, Yoshinari; Ishiguro, Misako; Tasaka, Kanji; Mimura, Yuichi; Nemoto, Toshiyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 25p. Order Number DE90513748. Source: NTIS (US Sales Only), PC A03/MF A01.

A developmental version of the RELAP5/Mod3 code (as of June 1989) was assessed for accuracy using experimental data taken for high-pressure (7MPa) steam-water two-phase flow in a large-diameter (0.18 m) horizontal-pipe test section of the ROSA-IV Two-Phase Flow Test Facility (TPTF). The agreement between the measured and calculated test section void fractions was much better than that for the previous generation of RELAP5 (MOD2). The improvement was achieved primarily due to the code changes with respect to the flow stratification criterion and interfacial-drag calculation scheme. (author).

44339 (JAERI-M–90-055) **IDAS-RR: an incident data base system for research reactors: User's manual.** Matsumoto, Kiyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kohsaka, Atsuo; Kaminaga, Masanori; Murayama, Youji; Ohnishi, Nobuaki; Maniwa, Masaki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 242p. (In Japanese). Order Number DE90513798. Source: NTIS (US Sales Only), PC A11/MF A01.

An Incident Data Base System for Research Reactors, IDAS-RR, has been developed. IDAS-RR has information about abnormal incidents (failures, transients, accidents, etc.) of research reactors in the world. Data reference, input, editing and other functions of IDAS-RR are menu driven. The routine processing and data base management functions are performed by the system software and hardware. PC-9801 equipment was selected as the hardware because of its portability and popularity. IDAS-RR provides effective reference information for the following activities. (1) Analysis of abnormal incident of research reactors, (2) Detail analysis of research reactor behavior in the abnormal incident for building the knowledge base of the reactor emergency diagnostic system for research reactor, (3) Planning counter-measure for emergency situation in the research reactor. This report is a user's manual of IDAS-RR. (author).

44340 (NUREG–0090-Vol.13-No.1) **Report to Congress on abnormal occurrences, January–March 1990: Volume 13, No. 1.** Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data. Jul 1990. 31p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event that the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from January 1 through March 31, 1990. for this reporting period, there were 10 abnormal occurrences. One involved the loss of vital ac power with a subsequent reactor coolant system heat-up at the Vogtle Unit 1 nuclear power plant during shutdown. The event was investigated by an NRC Incident Investigation Team (IIT). The other nine abnormal occurrences involved nuclear material licensees and are described in detail under other NRC-issued licenses: eight of these involved medical therapy misadministrations; the other involved the receipt of an unshielded radioactive source at Amersham Corporation in Burlington, Massachusetts. The latter event was also investigated by an NRC IIT. No abnormal occurrences were reported by the Agreement States. The report also contains information that updates a previously reported abnormal occurrence.

44341 (NUREG/CR–5373) **A demonstration experiment of steam-driven, high-pressure melt ejection: The HIPS-10S Test.** Allen, M.D. (Sandia National Labs., Albuquerque, NM (USA)); Pitch, M.; Nichols, R.T. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 71p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–89-1135). Source: NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

A steam blowdown test was performed at the Surtsey Direct Heating Test Facility to test the steam supply system and burst diaphragm arrangement that will be used in subsequent Surtsey Direct Containment Heating (DCH) experiments. Following successful completion of the steam blowdown test, the HIPS-10S (High-Pressure Melt Streaming) experiment was conducted to demonstrate that the technology to perform steam-driven, high-pressure melt ejection (HPME) experiments has been successfully developed. In addition, the HIPS-10S experiment was used to assess techniques and instrumentation design to create the proper timing of events in HPME experiments. This document discusses the results of this test.

44342 (NUREG/CR–5448) **Aging evaluation of class 1E batteries: Seismic testing.** Edson, J.L. (EG and G Idaho, Inc., Idaho Falls, ID (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1990. 210p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2576). Source: NTIS, PC A10/MF A01; OSTI; INIS.

This report presents the results of a seismic testing program on naturally aged class 1E batteries obtained from a nuclear plant. The testing program is a Phase 2 activity resulting from a Phase 1 aging evaluation of class 1E batteries in safety systems of nuclear power plants, performed previously as a part of the US Nuclear Regulatory Commission's Nuclear Plant Aging Research Program and reported in NUREG/CR-4457. The primary purpose of the program was to evaluate the seismic ruggedness of naturally aged batteries to determine if aged batteries could have adequate electrical capacity, as determined by tests recommended by IEEE Standards, and yet have inadequate seismic ruggedness to provide needed electrical power during and after a safe shutdown earthquake (SSE) event. A secondary purpose of the program was to evaluate selected advanced surveillance methods to determine if they were likely to be more sensitive to the aging degradation that reduces seismic ruggedness. The program used twelve batteries naturally aged to about 14 years of age in a nuclear facility and tested them at four different seismic levels representative of the levels of possible earthquakes specified for nuclear plants in the United States. Seismic testing of the batteries did not cause any loss of electrical capacity. 19 refs., 29 figs., 7 tabs.

44343 (NUREG/CR–5528) **An assessment of BWR [boiling water reactor] Mark-II containment challenges, failure modes, and potential improvements in performance.** Kelly, D.L. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Jones, K.R.; Dallman, R.J.; Wagner, K.C. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (USA). Jul 1990. 314p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2593). Source: NTIS, PC A14/MF A01 - GPO; OSTI; INIS.

This report assesses challenges to BWR Mark II containment integrity that could potentially arise from severe accidents. Also assessed are some potential improvements that could prevent core damage or containment failure, or could mitigate the consequences of such failure by reducing the release of fission products to the environment. These challenges and improvements are analyzed via a limited quantitative risk/benefit analysis of a generic BWR/4 reactor with Mark II containment. Point estimate frequencies of the dominant core damage sequences are obtained and simple containment event trees are constructed to evaluate the response of the containment to these severe accident sequences. The resulting

containment release modes are then binned into source term release categories, which provide inputs to the consequence analysis. The output of the consequences analysis is used to construct an overall base case risk profile. Potential improvements and sensitivities are evaluated by modifying the event tree spilt fractions, thus generating a revised risk profile. Several important sensitivity cases are examined to evaluate the impact of phenomenological uncertainties on the final results. 75 refs., 25 figs., 65 tabs.

44344 (NUREG/CR–5579) **Value/impact assessment of jet impingement loads and pipe-to-pipe impact damage: Revised methods and criteria.** Brown, J.B. Jr. (Pacific Northwest Lab., Richland, WA (USA)); Bampton, M.C.C.; Atzheimer, J.M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 62p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–7339). Source: NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

To account for effects that might result from a loss-of-coolant accidents (LOCA), nuclear power plant designers have been required to analyze the effects of double-ended guillotine breaks (DEGB) in high-energy piping. The US Nuclear Regulatory Commission (NRC), through its Standard Review Plan (SRP), requires that plant designers follow certain prescribed methods and criteria in the estimation of dynamic effects associated with the postulated rupture of piping. The work reported in this NUREG is intended to provide the basis for NRC decisions on adopting revisions to parts of the SRP 3.6.2 entitled "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping." The revisions considered in this work evaluated updated prescriptions for calculating jet impingement forces on critical systems and the requirement to consider pipe-whip damage to a new population of pipes. In accordance with the procedures documented in NUREG/CR-3586 entitled "A Handbook for Value-Impact Assessment," this report found indication that substantial costs and occupational radiation exposure would result from the proposed action without substantially reducing the risks to public health and safety. 21 refs., 2 figs., 18 tabs.

44345 (NUREG/IA–0033) **Assessment of RELAP5/MOD2, Cycle 36.04 against LOFT small break experiment L3-6.** Eriksson, J. (Swedish Nuclear Power Inspectorate, Stockholm (Sweden)). Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Swedish Nuclear Power Inspectorate, Stockholm (Sweden). Jul 1990. 100p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A06/MF A01 - GPO - OSTI.

The LOFT small break experiment L3-6 has been analyzed as part of Sweden's contribution to the International Thermal-Hydraulic Code Assessment and Applications Program (ICAP). Three calculations, of which two were sensitivity studies, were carried out. The following quantities were varied: the content of secondary side fluid and the feed water valve closure, and the two-phase characteristics of the main pumps. All three predictions agreed reasonably well with most of the measured data. The sensitivity calculations resulted only in marginal improvements. The predicted and measured data are compared on plots and their differences are quantified over intervals in real time.

44346 (PB–90-228206/XAB) **Security of nuclear reactors and special nuclear materials. Directive.** Pike, R. Office of the Deputy Under Secretary of Defense for Policy, Washington, DC (USA). 6 Apr 1990. 24p. (DOD-D–5210.63). Source: NTIS, PC A03/MF A01.

Supersedes PB–90-175449.

The Directive reissues DoD Directive 5210.63, April 24, 78, to update policy, responsibilities, procedures, and minimum standards for safeguarding DoD nuclear reactors and special nuclear materials (SNM).

44347 (PNL-SA–15644) **Viscosity of zirconium-uranium oxide ($Zr-UO_2$) mixtures at 2075 to 2375 K.** Bunnell, L.R.; Prater, J.T. Pacific Northwest Lab., Richland, WA (USA). Feb 1988. 25p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90015547. Source: NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

The viscosities of $Zr–UO_2$ mixtures have been measured as part of a program to determine the physical properties of light-water reactor materials at high temperatures. These data are required to model the melting and flow behavior of reactor fuel rods during the loss-of-coolant accident. In this work, the viscosities of $Zr–UO_2$ mixtures with 0 to 30 mol % UO_2 were measured at temperatures of 2075 to 2475 K. The viscosities of the $Zr-UO_2$ mixtures were relatively constant, varying between 10 and 17 centipoise over the composition range studied. However, the apparent melting temperature at which fluid flow was first observed depended on composition. In addition, the apparent melting point of compositions with greater than 15 mol % UO_2 also appeared to depend on the microstructure of the solid material. Metallographic characterization of the cooled samples indicated that equilibrated mixtures were obtained. 5 refs., 12 figs.

44348 (Risley-Trans–5923) **Nuclear power stations in August: Information and commentary.** Rogozhin, Yu. UKAEA Northern Research Labs., Risley (UK). 1989. 3p. Translated from Izvestiya, 6 September 1989. Order Number DE90637003. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Translated from Izvestiya, 6 September 1989.

A summary of events at nuclear power stations in the USSR in August 1989 is given. There were 44 nuclear power units in service which had 9 unplanned shutdowns and 13 unsanctioned power reductions. Gosatomenergonadzor SSSR is also responsible for all research and marine reactors. It is reported that there are currently (1989) six nuclear vessels in the USSR and no major accidents or damage to nuclear steam-generating units on these were reported. On-site inspectors maintain a constant presence at nuclear power stations to supervise operation and make sure safety requirements are enforced. Glasnost is opening up previously forbidden areas to the public to enable it to obtain information to allow objective assessment to be made. (author).

44349 (SAND–89-2101/3) **N Reactor probabilistic risk assessment supporting calcuations: Volume 3, Appendices H–U.** Miller, L.A. (Sandia National Labs., Albuquerque, NM (USA)); Wyss, G.D.; Kunsman, D.M.; Dingman, S.E.; Boucheron, E.A.; Carmel, M.K.; Shaffer, C.J. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 700p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC04-76DP00789. Order Number DE90014861. Source: NTIS, PC A99/MF A01 - OSTI; GPO Dep.

For Westinghouse Hanford Co., Richland, WA.

This document, Volume 3, provides the appendices H–V of this report. These appendices contain risk assessment supporting calculations. (FI)

44350 (SAND–89-3010C) **CONTAIN code calculations for the LA-4 experiment.** Gelbard, F.; Tills, J.L.; Murata, K.K. Sandia National Labs., Albuquerque, NM (USA). [1990]. 14p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-901024–4: 2. international conference on containment design and operation, Toronto (Canada), 14-17 Oct 1990). Order Number DE90012753. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The CONTAIN code is a system-level analysis tool developed for the USNRC, and is intended for best-estimate prediction of conditions which might occur in the containment building of a nuclear power plant during a severe accident. A key feature of the code is that it models the containment phenomena in an integrated manner. In particular, the CONTAIN code models some of the complex ways that thermal hydraulics and aerosol phenomena interact with each other. The Light Water Reactor Aerosol Containment Experiment (LACE) progarm is a program to aid researchers in their understanding of thermal hydraulic and aerosol behavior within containments. The purpose of this paper is to report on best-estimate LA-4 post-test calculations that have been completed with the most recent version of the CONTAIN code, version 1.11. An analysis of experimental data and review of the blind post-test CONTAIN calculations is used to justify a re-calculation of the experiment and to establish a best-estimate calculation. The best-estimate calculation shows that reasonably good agreement between thermal hydraulic predictions and data can be obtained with the current CONTAIN models by varying experimental parameters within their uncertainties. Furthermore, with the recently

added solubility model for hygroscopic aerosols, the best-estimate calculation gives aerosol behavior that is in good agreement with aerosol data. 10 refs., 16 figs.

44351 (SAND–89-3096C) **Comparison of CONTAIN code simulations to experimental ice condenser test data.** Russell, N.A.; Williams, D.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 16p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-901024–5: 2. international conference on containment design and operation, Toronto (Canada), 14-17 Oct 1990). Order Number DE90012755. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent severe reactor accident calculations focusing on ice condenser containment issues, using the Sequoyah ice condenser containment as a representative plant, indicate that detonable hydrogen concentrations may occur within the ice condenser and possibly elsewhere in the containment. These calculations, which were performed with the CONTAIN code, were sensitive to the natural convection predicted by the code. Because CONTAIN is a lumped-parameter, control volume code, it is not clear that it can accurately calculate conditions within complicated flow patterns of this type. Therefore, it is important to test CONTAIN's ability to treat this class of problems. In this paper, the ability of the CONTAIN code to analyze conditions within ice condenser containments is evaluated.

44352 (SAND–89-3104C) **Severe accident mitigation through containment design.** Bergeron, K.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901024–3: 2. international conference on containment design and operation, Toronto (Canada), 14-17 Oct 1990). Order Number DE90012240. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent US Department of Energy plans to construct a Heavy Water Reactor for the production of defense nuclear materials have created a unique opportunity to explore ways to mitigate severe accident concerns in the design stage. Drawing on an extensive background in USNRC-sponsored severe accident work, Sandia National Laboratories has been exploring a number of Heavy Water New Production Reactor (HW-NPR) containment design strategies that might mitigate the consequences of a core-melt accident without greatly impacting construction cost or reactor operations. Severe accident specialists have undertaken these assessments with the intent of providing the plant designers with some of the phenomenological advantages and disadvantages of various mitigation strategies. This paper will highlight some of the more interesting concepts and summarize the results obtained. 9 refs., 2 tabs.

44353 (SAND–89-3105C) **An assessment of the effectiveness of potential improvements for ice condenser containments.** Williams, D.C.; Gregory, J.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 15p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-901024–2: 2. international conference on containment design and operation, Toronto (Canada), 14-17 Oct 1990). Order Number DE90012151. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Using Sequoyah as a representative plant, the CONTAIN severe accident analysis code has been employed to evaluate the ability of several proposed containment improvements to reduce the threat to containment integrity associated with direct containment heating (DCH) and hydrogen combustion in ice condenser plants during station blackout accidents. Calculations were performed using 4-cell, 6-cell, and 26-cell representations of the containment. Potential improvements considered included containment venting, improved igniter systems (including backup power supplies), containment inerting, subatmospheric containment, reduced ice condenser bypass, backup power supplies for the air return fans, and intentional depressurization of the reactor coolant system (RCS). The most effective improvements considered were inerting of the containment atmosphere, and the combination of depressurization of the RCS and provision of backup power for the igniter systems. Either of these approaches could substantially reduce, though perhaps not totally eliminate, the threat to containment integrity associated with DCH and hydrogen deflagrations. The other improvements considered offered at best only moderate mitigation, which would probably be insufficient to substantially alter the contribution of DCH to risk in PRAs such as those reported in NUREG-1150. 11 refs., 2 figs., 5 tabs.

44354 (SAND–90-0113C) **Application of phenomenological calculations to the N Reactor probabilistic risk assessment.** Miller, L.A.; Wyss, G.D.; Wheeler, T.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900917–11: American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities, Boise, ID (USA), 30 Sep - 3 oct 1990). Order Number DE90015166. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A deterministic phenomenological calculation generates only a single best estimate result. However, probabilistic risk assessment (PRA) accident progression calculations require phenomenological data in the form of probability distributions. A three step process, to provide such distributions, consisting of issue identification, deterministic calculation specification, and the use of expert judgment to interpret the results, is described in this paper. The results of a sample expert judgment elicitation from the N Reactor PRA are included to demonstrate how the uncertainties associated with deterministic calculations are accounted for in the final probability distributions that are based on those calculations. 6 refs., 2 figs., 3 tabs.

44355 (SAND–90-1366C) **Summary of NRC-sponsored research on containment integrity.** Parks, M.B.; Horschel, D.S.; von Riesemann, W.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 17p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-901024–1: 2. international conference on containment design and operation, Toronto (Canada), 14-17 Oct 1990). Order Number DE90011903. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Under the sponsorship of the United States Nuclear Regulatory Commission (NRC), Sandia National Laboratories is conducting several research programs with the common goal of developing a complete methodology for the prediction of the ultimate pressure capacity, at elevated temperatures, of light water reactor (LWR) containment systems. These programs are collectively known as the Containment Integrity Programs. This paper will provide a brief overview of these programs. As a part of the Containment Integrity Programs, a series of scale model containment test have been conducted at Sandia including a 1:8-scale steel model and a 1:6 scale reinforced concrete model. The model were pneumatically pressurized up to point of functional failure; that is, the point at which the containment was no longer effective in preventing significant leakage past its pressure boundary. Also, a 1:10-scale prestressed concrete model has been hydrostatically tested in the United Kingdom under a cooperative agreement with the NRC and others. Because the containment pressure boundary consists of numerous mechanical and electrical penetrations, several independent test programs of typical penetrations have also been performed to determine their leakage behavior when subjected to severe accident conditions. Completed containment penetration research programs include testing of typical compression seals and gaskets, inflatable seals, a personal air lock and electrical penetration assemblies (EPAs). Also, an investigation of leakage due to ovalization of penetration sleeves has been conducted as a part of the scale model test. Currently, testing of the unseating equipment hatch of the 1:6-scale containment model is under way. 23 refs., 3 figs., 2 tabs.

44356 (SRD-R–502) **The role of high temperature heterogeneous reaction kinetics in the rate of radionuclide vaporisation during core-concrete interactions.** Raymond, D.P.; Clough, P.N. UKAEA Safety and Reliability Directorate, Culcheth (UK). Sep 1989. 33p. Order Number DE90636808. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Heterogeneous reactions may cause enhanced release of radionuclides during the core-concrete interaction (CCI) stage of a PWR severe accident. The VANESA computer code models these CCI releases using chemical equilibrium assumptions; however, the possibility that chemical kinetics could prevent equilibrium from

being achieved is considered in this report. Direct experimental evidence is lacking on these reactions. Therefore, some analogues studies are reviewed, including examples of Eyring's surface reaction rate theory; sequential vaporisation-oxidation processes; iron and steelmaking chemistry; radionuclide evaporation from solid UO_2. This circumstantial evidence appeared to agree with the current assumptions, in VANESA and some UK modelling studies, that mass transfer, rather than chemical kinetics will limit the rate at which equilibrium is attained. (author).

44357 (SRD-R-512) **The medical implications of nuclear power plant accidents.** Tyror, J.G.; Pearson, G.W. UKAEA Safety and Reliability Directorate, Culcheth (UK). Nov 1989. 36p. (CONF-8906344--: Conference on medical response to effects of ionising radiation, London (UK), 28 Jun 1989). Order Number DE90636809. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This paper examines the UK position regarding the potential for an accident at a nuclear power plant, the safeguards in place to prevent such an accident occurring and the emergency procedures designed to cope with the consequences should one occur. It focuses on the role of the medical services and examines previous accidents to suggest the nature and likely scale of response that may need to be provided. It is apparent that designs of UK nuclear power stations are robust and that the likelihood of a significant accident occurring is extremely remote. Emergency arrangements are, however, in place to deal with the eventuality should it arise and these incorporate sufficient flexibility to accommodate a wide range of accidents. Analysis of previous nuclear accidents at Windscale, Three Mile Island and Chernobyl provide a limited but valuable insight into the diversity and potential scale of response that may be required. It is concluded that above all, the response must be flexible to enable medical services to deal with the wide range of effects that may arise. (author).

44358 (SSI-90-04) **Radioactive cesium in fish in Swedish lakes after Chernobyl.** Andersson, Tord (Umeaa Univ. (Sweden). Naturgeografiska Avd.); Forsgren, G.; Malmgren, L.; Nilsson Aake; Haakanson, L. National Inst. of Radiation Protection, Stockholm (Sweden). 30 Jan 1990. 42p. (In Swedish). Order Number DE90636798. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In summary, it may be stated that the objectives of this project have been: To collect and process all available Swedish data from 1986-1988 as regards Cs-137 in freshwater fish, water and sediments and lake 'sensitivity' parameters (e.g. pH, other water-chemistry parameters and data on lake morphometry) and to only accept data that corresponded to given quality requirements; To attempt to provide a picture as detailed as possible of how the cesium concentration varied geographically in Sweden during 1986, 1987 and 1988 in different fish species; To try to obtain a picture of how different lake properties influence the proportion of the lake Cs-load that is taken up in biological material; this is interesting and important when creating corrective strategies to speed-up recovery. This implies that we will try to develop load diagrams (effect-dose-sensitivity- diagrams); To attempt to provide a picture of how the cesium concentration varies between different species, seasonally and with fish size. This report takes up only mean values for Swedish lakes smaller than 10 km^2. Interest has mainly concerned perch, pike, whitefish, char and trout. Data on the following water chemical parameters are given in the register: pH, alkalinity, conductivity, colour, total-P, Fe, hardness (CaMg), K, $KMnO_4$ and Secci-disc transparency. (8 tabs., 11 figs., 9 refs.).

44359 (SSI-90-07) **Consequences in Sweden of the Chernobyl accident.** Haegg, Conny. National Inst. of Radiation Protection, Stockholm (Sweden). 23 Feb 1990. 21p. Order Number DE90636799. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The radiation doses to man in Sweden due to the Chernobyl accident originate mainly from external irradiation from deposited radionuclides and internal irradiation from consumption of radioactively contaminated food stuffs. Inhalation and external irradiation from the passing cloud give only a minor contribution to the total dose. As an average for the Swedish population the individual radiation dose during the first year amounts to about 0.1 mSv, i.e. 10% of the natural background radiation. In the most contaminated areas, however, the individual dose may become 30 times higher than the average dose. The dose committed over 50 years has estimated to be about six times as high as the first year dose. The collective dose for the Swedish population has been estimated to about 1300 manSv the first year after the accident and the corresponding dose over 50 years to 5000 to 7000 manSv. This could lead to 100 to 200 extra fatal cancers. Furthermore, no damages on man that can be related to Chernobyl fallout, e.g. pre-natal effects, have so far been observed in Sweden. Shortly after the accident, several research projects were initiated in Sweden in order to follow the distribution of radionuclides in the aquatic and terrestrial environment. The results which in many cases are preliminary, shows that the recovery of the ecosystem will take several decades. (author).

44360 (WHC-SA-0817-Rev.1) **SP-100 design, safety, and testing: Revision 1.** Smith, G.L.; Cox, C.M.; Mahaffey, M.K. Westinghouse Hanford Co., Richland, WA (USA). Jul 1990. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-900917-12-Rev.1: American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities, Boise, ID (USA), 30 Sep - 3 oct 1990). Order Number DE90015374. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The SP-100 Program is developing a nuclear reactor power system that can enhance and/or enable future civilian and military space missions. The program is directed to develop space reactor technology to provide electrical power in the range of tens to hundreds of kilowatts. The major nuclear assembly test is to be conducted at the Hanford Site near Richland, Washington, and is designed to validate the performance of the 2.4-MWt nuclear and heat transport assembly. 10 refs., 5 figs.

44361 Transactions of the 10th international conference on structural mechanics in reactor technology: Volume C. Fuel elements and assemblies. Hadjian, A.H. (Bechtel Power Corp., Los Angeles, CA (USA)). 99p. American Association for Structural Mechanics in Reactor Technology, Los Angeles, CA (USA) (1989). (CONF-890855--: 10. international conference on Structural Mechanics in Reactor Technology (SMIRT), Anaheim, CA (USA), 14-18 Aug 1989).

This book contains the transactions of the 10th international conference on structural mechanics in reactor technology, volume C, fuel elements and assemblies. Topics covered include: thermal reactor assemblies, fast reactor fuel elements, and thermal reactor fuel elements.

44362 Transactions of the 10th international conference on structural mechanics in reactor technology: Volume L. Inelastic behavior of metals and constitutive laws of materials. Hadjian, A.H. 231p. American Association for Structural Mechanics in Reactor Technology, Los Angeles, CA (USA) (1989). (CONF-890855--: 10. international conference on Structural Mechanics in Reactor Technology (SMIRT), Anaheim, CA (USA), 14-18 Aug 1989).

This book covers all aspects of engineering mechanics pertaining to mechanical and structural components and the relevant systems in nuclear reactors. Topics include theoretical developments in structural mechanics, loading conditions, behavior of materials, fluid mechanics, operating experience, accident sequences, and calculational procedures. Problems of structural mechanics analysis are focused within the general context of the design, reliability, and safety of nuclear reactors. The papers are theoretical or applied, or they address both of these aspects to demonstrate application of developed methods to solve specific design problems and show how well actual behavior correlates with theory.

44363 Validation of models for the analysis of the transient behavior of metallic fast reactor fuel. Kramer, J.M. (Argonne National Lab., IL (USA)); Hughes, T.H.; Gruber, E.E. pp. 65-76 of Transactions of the 10th international conference on structural mechanics in reactor technology: Volume C. Hadjian, A.H. American Association for Structural Mechanics in Reactor Technology, Los Angeles, CA (USA) (1989). (CONF-890855--: 10. international conference on Structural Mechanics in Reactor Technology (SMIRT), Anaheim, CA (USA), 14-18 Aug 1989).

This paper discusses U-Pu-Zr metal alloys as a fuel for sodium-cooled fast reactors. The authors address verification and validation as components in the development of models and computer codes. They present the results of recent progress in the validation of models for the analysis of the behavior of metallic fast reactor fuel.

44364 Global optimization and sensitivity analysis. Cacuci, D.G. (California Univ., Santa Barbara, CA (USA). Dept. of Chemical and Nuclear Engineering). *Nuclear Science and Engineering (USA)*, 104(1): 78-88 (Jan 1990).

A new direction for the analysis of nonlinear models of nuclear systems is suggested to overcome fundamental limitations of sensitivity analysis and optimization methods currently prevalent in nuclear engineering usage. This direction is toward a global analysis of the behavior of the respective system as its design parameters are allowed to vary over their respective design ranges. Presented is a methodology for global analysis that unifies and extends the current scopes of sensitivity analysis and optimization by identifying all the critical points (maxima, minima) and solution bifurcation points together with corresponding sensitivities at any design point of interest. The potential applicability of this methodology is illustrated with test problems involving multiple critical points and bifurcations and comprising both equality and inequality constraints.

24 POWER TRANSMISSION AND DISTRIBUTION

2401 Power Systems

Refer also to citation(s) 44472

44365 (ORNL/TM–11323) **Bonneville Power Administration Communication Alarm Processor expert system: Design and implementation.** Goeltz, R. (Oak Ridge National Lab., TN (USA)); Purucker, S.; Tonn, B.; Wiggen, T.; MacGregor, D. Oak Ridge National Lab., TN (USA). Jun 1990. 80p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC05-84OR21400. Order Number DE90014781. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report describes the Communications Alarm Processor (CAP), a prototype expert system developed for the Bonneville Power Administration by Oak Ridge National Laboratory. The system is designed to receive and diagnose alarms from Bonneville's Microwave Communications System (MCS). The prototype encompasses one of seven branches of the communications network and a subset of alarm systems and alarm types from each system. The expert system employs a backward chaining approach to diagnosing alarms. Alarms are fed into the expert system directly from the communication system via RS232 ports and sophisticated alarm filtering and mailbox software. Alarm diagnoses are presented to operators for their review and concurrence before the diagnoses are archived. Statistical software is incorporated to allow analysis of archived data for report generation and maintenance studies. The delivered system resides on a Digital Equipment Corporation VAX 3200 workstation and utilizes Nexpert Object and SAS for the expert system and statistical analysis, respectively. 11 refs., 23 figs., 7 tabs.

44366 Applicability of variable frequency control is not a general statement. Karmous, M. (North Carolina Agricultural and Technical State Univ., Greensboro, NC (USA)); Smith, G. pp. 469-472 of Strategies for reducing natural gas, electric and oil costs. Association of Energy Engineers, Atlanta, GA (USA) (1990). (CONF-891028–: 12. world energy engineering congress, Atlanta, GA (USA), 24-28 Oct 1989).

Not every motor that runs at partial load is a good candidate for variable frequency control (VFC) drives to save energy with a reasonable payback period. An economic evaluation of VFC was performed. The project consisted of metering the electrical demand of four induction motors driving conveyors ranging in size from 40 to 400 horse power. The data was analyzed to determine if VFC will pay for itself in less than three years. Results indicate that of the four motors metered, a 250 hp motor was a good candidate for VFC.

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 44190, 44195, 44867, 45029, 45039

44367 (OH/RD–260T507) **Gas-in-oil analysis as an acceptance criterion during transformer factory overload testing.** Azizian, H. (Ontario Hydro, Toronto, ON (Canada)). Ontario Hydro Research Div., Toronto, ON (Canada). May 1989. 67p. (CE–02839). Source: Canadian Electrical Association, Research & Development, Suite No. 500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS, MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

To provide a power transformer of proven performance and long field life, stringent factory overload/heat run acceptance tests are being requested by various electrical utilities. Since incipient faults cannot always be detected from winding and oil temperature rise, gas-in-oil analysis before and after the factory tests is used for monitoring. A project was initiated whose main objective was to develop the experimental information required to set a standard acceptance criteria for transformer factory overload/heat run tests. To achieve the above objective, the existing factory heat run/overload gas-in-oil data were analyzed. It was found that the measured hydrocarbon gas concentrations were not statistically significant, indicating some deficiencies in the current factory test procedure, or that the tested transformers had no overheating problems. To simulate hot spot temperatures inside large power transformers and their effect on insulating material, laboratory tests were carried out using model coils to determine the rates of production of gaseous breakdown by-products, under well defined conditions. The rates were found to be dependent on moisture content and temperature but not oxygen content over the range studied. These data were used to develop a mathematical model that gives predicted concentrations of gases as a function of conductor temperature and moisture content of the insulating oil. The model was applied to a new 750 MVA power transformer and the results were compared with field data. Finally, the information generated above was used to set up a standard acceptance criterion for new transformers. 29 refs., 14 figs., 9 tabs.

44368 The stability control upgrade on the Pacific Northwest-Southwest AC and DC interties. Haner, J.M. (Bonneville Power Administration, Portland, OR (USA)). pp. 75-86 of Instrumentation in the power industry: Volume 32. Instrument Society of America, Research Triangle Park, NC (USA) (1989). (CONF-8905309–: 32. power instrumentation symposium, Phoenix, AZ (USA), 22-24 May 1989).

Technical Paper 89-1011.

Operation of many power systems require elaborate stability controls to maintain a stable power transfer under normal, and stressed, operating conditions. This paper reports that microprocessor based fault tolerant controls are now being more widely used to solve many stability problems on complex power grids.

2403 Power Transmission Lines and Cables

Refer also to citation(s) 45029, 46088

44369 (EPRI-EL–6420-Vol.23) **TLWorkstation™ code: Version 2.0: Volume 23: ETADS [EPRI Tower Analysis and Design System] user's manual: Final report.** Goodwin, E.J. (Sverdrup Technology, Inc., Haslet, TX (USA)). Electric Power Research Inst., Palo Alto, CA (USA); Sverdrup Technology, Inc., Haslet, TX (USA). ©Jul 1990. 578p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This User's Manual provides information necessary for operating the EPRI Tower Analysis and Design System (ETADS), a displacement based, finite-element structural analysis computer package developed specifically for static and dynamic analysis AND design of transmission type structures. ETADS is a task module of the Electric Power Research Institute's (EPRI) TLWorkstation™. ETADS contains a variety of elements that can be used to simulate the behavior of lattice, pole, H-frame, and guyed transmission line structures. The User's Manual describes the fundamentals of the analysis methodologies used in ETADS and the procedures used

for building structure models for analysis. Sections to help the user in selecting analysis options, utilizing the post analysis processors that provide graphic displays of displacements and stress levels, and understanding tabular reports of analysis results are included. The manual includes an index and cross-referencing by page reference and flow chart reference to make information readily available to the user to resolve application questions.

44370 (EPRI-EL–6800) **Manual on estimating soil properties for foundation design: Final report.** Kulhawy, F.H. (Cornell Univ., Ithaca, NY (USA). Geotechnical Engineering Group); Mayne, P.W. Electric Power Research Inst., Palo Alto, CA (USA); Cornell Univ., Ithaca, NY (USA). Geotechnical Engineering Group. ©Aug 1990. 298p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This manual focuses on the needs of engineers involved in the geotechnical design of foundations for transmission line structures. It also will serve as a useful reference for other geotechnical problems. In all foundation design, it is necessary to know the pertinent parameters controlling the soil behavior. When it is not feasible to measure the necessary soil parameters directly, estimates will have to be made from other available data, such as the results of laboratory index tests and in-situ tests. Numerous correlations between these types of tests and the necessary soil parameters exist in the literature, but they have not been synthesized previously into readily form in a collective work. This manual summarizes the most pertinent of these available correlations for estimating soil parameters. In many cases, the existing correlations have been updated with new data, and new correlations have been developed where sufficient data have been available. For each soil parameter, representative correlations commonly are presented in chronological order to illustrate the evolutionary development of the particular correlation. The emphasis is on relatively common laboratory and in-situ tests and correlations, including those tests that are seeing increased use in practice.

44371 (EPRI-EL–6901) **Advanced tree-trimming equipment: Final report.** Johnston, P.A. (Environmental Consultants, Inc., Southampton, PA (USA)); Gillon, J.P. Electric Power Research Inst., Palo Alto, CA (USA); Environmental Consultants, Inc., Southampton, PA (USA). ©Jul 1990. 39p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

A project funded by the Electric Power research Institute has produced a working prototype of a pantograph linkage supported, telescopic pole type tool with interchangeable cutting heads for trimming trees around electrical conductors. The tool is designed for mounting on the bucket of an aerial lift of the type commonly used for tree trimming. The three-section telescopic pole is constructed of non-conductive, filament wound, fiber-glass reinforced epoxy and is adjustable from an overall length of 7 feet to a fully extended length of 17 feet. The project goal was to obtain a 20% improvement in productivity of tree crews. Productivity gains are expected to result from fewer truck set-ups, faster tool positioning, and reduced user fatigue. The next phase of the project will involve test and evaluation of the prototype and will quantify actual productivity gains.

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 44481

44372 (CONF-900801–25) **Analysis of power sector efficiency improvements for an integrated utility planning process in Costa Rica.** Waddle, D.B.; MacDonald, J.M. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. Agency for International Development; U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990. Order Number DE90015163. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In an effort to analyze and document the potential for power sector efficiency improvements from generation to end-use, the Agency for International Development and the Government of Costa Rica are jointly conducting an integrated power sector efficiency analysis. Potential for energy and cost savings in power plants, transmission and distribution, and demand-side management programs are being evaluated. The product of this study will be an integrated investment plan for the Instituto Costarricense de Electricidad, incorporating both supply and demand side investment options. This paper presents the methodology employed in the study, as well as preliminary estimates of the results of the study. 14 refs., 4 figs., 5 tabs.

44373 (ISTC–90-00820) **Industry profile: Electrical wire and cable.** Industry, Science and Technology Canada, Ottawa, ON (Canada). 1988. 15p. (MICROLOG–90-00820). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report is about the strengths and weaknesses of the Canadian wire and cable industry. There are 3 main market segments in this industry: electrical utilities, telecommunication utilities and the construction industry. The structure of the industry and its performance in domestic and foreign markets are illustrated by statistical data on trade and employment. The strengths and weaknessess of the industry are discussed. There will probably be a rationalization of the industry due to Canada's Free-Trade Agreement (F.T.A.) with the U.S.A. In conclusion, the lower-technology products of the sector, such as building wire, are not fully competitive internationally, but continue to be produced in Canada because of the protection that they are given by subsidized transportation cost and Canadian tariffs. Implementation of the F.T.A. will change these factors. On the other hand, higher-technology products, such as power and telecommunication cables, are competitive internationally. The text of the report is provided both English and French. 2 figs., 5 tabs.

25 ENERGY STORAGE

2509 Batteries

Refer also to citation(s) 44597, 44598

44374 (AD-A–221872/5/XAB) **Experimental evaluation of the synthetic solid-electrolyte interface (SSEI) concept for the primary Ca-SOCl$_2$ battery system. Final report, 15 April-15 October 1988.** De Neufville, J.P. Voltaix, Inc., North Branch, NJ (USA). Dec 1988. 34p. Source: NTIS, PC A03/MF A01.

The Ca-SOCl(2) primary battery system has an excellent safety profile when subjected to a variety of abuse test conditions. Furthermore its theoretical energy density qualifies it for a variety of demanding Army and other DOD applications. Recently, significant improvements have been reported in the low temperature performance and the cathode capacity obtainable in this system. One major remaining flaw, however, is the corrosion of the Ca anode during storage at elevated temperature. Efforts to modify the electrolyte or provide a protective coating for the anode have had only limited success. The purpose of the present research has been to apply the concept of a synthetic solid electrolyte interface (SSEI) to overcome the problem of Ca corrosion in Ca-SOCl(2) primary cells.

44375 (AD-A–221919/4/XAB) **Cell performance of ultra-thin polymer-cathode cell systems. Part 2. Cation intercalating composite polymer cathode. Technical report, 1 January 1989-1 March 1990.** Naoi, K.; Smyrl, W.H.; Owens, B.B. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. 15 Mar 1990. 13p. (TR–25-ONR). Source: NTIS, PC A03/MF A01.

Theoretical specific energy and power densities for thin film Li/LE or SPE/CP cell systems were calculated by modeling a bipolar-design polymer cathode rechargeable cell with hardware where LE, SPE and CP represent the liquid electrolyte (2M LiClO4(PC)), solid polymer electrolyte (PEO(8)LiX) and the conductive polymer(polypyrrole). The cell performance is obtained for a cation-intercalating PPy-PVS composite film which is composed of polypyrrole(PPy) into which has been incorporated the polymer anion, polyvinylsolfonate(PVS) during deposition. The energy and

power densities are estimated as a function of cathode thickness (1 to 100,000 micron), active cell area (1 to 10,000 sq cm) and the number of bipolar units(1 to 100). Compared to the anion-consuming polymer cathode system, significant enhancement of specific energy was achieved. The theoretical specific energy amounts to ca. 290 Wh/kg (bare cell) and ca. 209 Wh/kg for a bipolar Li/LE or SPE/PPy-PVS cell system (with hardware).

44376 (PB–90-872920/XAB) **Battery electrolytes. December 1982-June 1990 (A Bibliography from the NTIS data base). Report for December 1982-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 131p. Source: NTISPC N01/MF N01.

Supersedes PB–84-855923.

This bibliography contains citations concerning solid, liquid, and gaseous battery electrolytes. Battery design, use, and construction are discussed, and battery life, efficiency, and maintenance characteristics are also considered. Lithium, lead, nickel-cadmium, and thermal battery systems are covered in a separate bibliography. (This updated bibliography contains 241 citations, 190 of which are new entries to the previous edition.)

44377 Chemical overcharge and overdischarge protection for Li-alloy/transition-metal sulfide cells. Redey, L. (Argonne National Lab., IL (USA). Chemical Technology Div.). *Journal of the Electrochemical Society (USA),* 136(7): 1989-1991 (Jul 1989). DOE Contract W-31-109-ENG-38.

Chemical overcharge protection by a polysulfide-shuttle mechanism has been proposed for lithium-alloy-disulfide cells; for example, disulfide is FeS_2, FeS_2-NiS_2 or FeS_2-CoS_2. This mechanism, however, cannot be applied to monosulfide (e.g., FeS) cells because the soluble polysulfide formation occurs at a much higher positive potential than the operational potential range of the monosulfide active material. For lithium-alloy/monosulfide cells, use of a controlled self-discharge process by the dissolved lithium as a means of chemical overcharge protection, has been developed and described in this article. The controlled self-discharge process, however, is not limited to the monosulfide cells. Because the protecting action is based on the negative electrode, this process is equally applicable to the mono- and disulfide cells. For the present experiments monosulfide cells were chosen to study the involved processes free from any interference of the polysulfide mechanisms.

44378 Lithium/organosulfur redox cell having protective solid electrolyte barrier formed on anode and method of making same. DeJonghe, L.C.; Visco, S.J.; Liu, M.; Mailhe, C.C. To Dept. of Energy, Washington, DC (USA). USA Patent 4917974/A/. 17 Apr 1990. Filed date 14 Apr 1989. USA Patent Application 7-337,978. Int. Cl. H01M 4/60. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a lithium/organosulfur redox cell. It comprises: a solid lithium anode, a liquid organosulfur cathode, and a barrier layer formed adjacent a surface of the solid lithium anode facing the liquid organosulfur cathode consisting of a reaction product of the lithium anode with the organosulfur cathode. The organosulfur cathode comprises a material having the formula $(R(S)_y)_N$ where y = 1 to 6, n = 2 to 20 and R is one or more different aliphatic or aromatic organic moieties having 1 to 20 carbon atoms, which may include one or more oxygen, sulfur, nitrogen, or fluorine atoms associated with he chain when R comprises an aliphatic chain, wherein the linear chain may be linear or branched, saturated or unsaturated, and wherein either the aliphatic chain or the aromatic ring may have substituted groups thereon.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 44065

2901 Energy Analysis and Modeling

Refer also to citation(s) 44372, 44446, 44556, 44573

44379 (EPRI-CU–6925) **Estimating efficiency savings embedded in electric utility forecasts: Final report.** Faruqui, A. (Barakat and Chamberlin, Inc., Oakland, CA (USA)); Seiden, K. Electric Power Research Inst., Palo Alto, CA (USA); Barakat and Chamberlin, Inc., Oakland, CA (USA). ©Aug 1990. 33p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The dual concerns about global warming and electricity supply shortages have heightened utility interest in the energy savings from efficient electric technologies. Efficient technologies are expected to penetrate end-use markets in response to a variety of signals: enhanced competitive pressures, rising energy prices, mandated standards, R&D activities, and utility DSM programs. EPRI initiated this study to develop estimates of the energy savings arising from energy prices, mandated standards, and R&D activities. The study results indicate that the penetration of efficient technologies will save 325,000 gWh in the year 2000, relative to a scenario where efficiency levels are frozen at their 1987 values. These savings represent an 8.5% reduction in energy use. 15 refs., 8 figs., 4 tabs.

44380 (PB–90-873316/XAB) **Energy supply and demand modeling. February 1985-March 1988 (A Bibliography from the NTIS data base). Report for February 1985-March 1988.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 112p. Source: NTISPC N01/MF N01.

See also PB–90-873324.

This bibliography contains citations concerning the use of mathematical models in trend analysis and forecasting of energy supply and demand factors. Models are presented for the industrial, transportation, and residential sectors. Aspects of long term energy strategies and markets are discussed at the global, national, state, and regional levels. Energy demand and pricing, and econometrics of energy, are explored for electric utilities and natural resources, such as coal, oil, and natural gas. Energy resources are modeled both for fuel usage and for reserves. (This updated bibliography contains 201 citations, none of which are new entries to the previous edition.)

44381 (PB–90-873324/XAB) **Energy supply and demand modeling. April 1988-June 1990 (A Bibliography from the NTIS data base). Report for April 1988-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 117p. Source: NTISPC N01/MF N01.

Supersedes PB–88-862198. See also PB–90-873316.

This bibliography contains citations concerning the use of mathematical models in trend analysis and forecasting of energy supply and demand factors. Models are presented for the industrial, transportation, and residential sectors. Aspects of long term energy strategies and markets are discussed at the global, national, state, and regional levels. Energy demand and pricing, and econometrics of energy, are explored for electric utilities and natural resources, such as coal, oil, and natural gas. Energy resources are modeled both for fuel usage and for reserves. (This updated bibliography contains 200 citations, all of which are new entries to the previous edition.)

2902 Economics and Sociology

Refer also to citation(s) 43702, 43770, 43780, 43781, 43829, 44207, 44304, 44390, 44391, 44417, 44429, 44455, 44459, 44468, 44475, 44476, 44482, 44484, 44513, 44573, 44601, 45044

44382 (CERI–90-01031, pp. 1-6, Section 3) **LNG [liquefied natural gas] supply and demand in Japan.** Toichi, T. (Inst. of Energy Economics, Japan, Tokyo (Japan)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This summary of liquefied natural gas (LNG) supply and demand in Japan covers markets and volumes from 1969 to the present, as well as demand increases to 2000 and the outlook for supply not only in Japan but in the entire Asia/West Pacific region. Demand is strong and increasing in the area. Projects in China, Alaska's North Slope, Qatar, and Sakhalin are planned but there are a number of obstacles to each. Whether the projected Japanese demand growth becomes a reality or not depends mainly on crude oil price trends and, in particular, on electric power demand, construction costs of LNG-related plant facilities and other related factors. 3 tabs.

44383 (CERI–90-01031, pp. 1-16, Section 3) **The European natural gas market.** Odell, P. (Centre for International Energy Studies, Erasmus Univ., Rotterdam (Netherlands)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Setting aside national differences (and excluding the U.K. and Italy), the west European gas system has emerged from the production/transmission facilities and the organisational structures based on the Dutch Groningen field development since the mid-60s. A set of monopoly outlets (one per country or region) was created to handle gas transmission and distribution. Except for the Netherlands, this action generally restricted gas markets to high value markets. The paper explores the causes and implications of this, then considers a number of situations which might bring about changes, among them competition between suppliers for a relatively stagnant market, the implementation of the Single Europe Act by the end of 1992, and perestroika in the Soviet Union, which may lead the Soviets to increase their exports in order to gain hard currency. 5 tabs., 3 figs.

44384 (CERI–90-01036, pp. 1-10, Paper 8) **The state of the world oil market.** Lamb, A.T. (Conant and Associates, Washington, DC (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper discusses developments in the world oil market since September 1986, the current situation, and a one-year outlook. The discussion includes both economic and political aspects in the Middle East and the Soviet Union. The outlook for the next year includes a pickup in spending by oil and gas producers around the world if OPEC maintains its strict quota discipline and its committment to oil price stability and if the price remains steady around its $18/bbl reference price. However, U.S. intervention in the Gulf war between Iran and Iraq had led to the need for studies on the geopolitical process of the international petroleum market to identify problems and find solutions.

44385 (EMR–BT31-2-1991-III-13) **Energy, Mines and Resources Canada, 1990-91 estimates: Part 3. Expenditure plan.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1990. 214p. (MICROLOG–90-03658). Source: PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $20.00; OTHER COUNTRIES: $24.00 CAN; MF $10 CAN.

Energy, Mines and Resources Canada is a scientific and economic-oriented department concerned primarily with Canada's landmass and the non-renewable resources it contains. The department's responsibilities lie in the areas of energy research and development, and policy implementation and development, in such fields as mineral resources, nonconventional materials, conservation and alternative energy, and enhancement of energy and mineral markets. This document presents budgetary estimates, along with summaries of departmental objectives and programs, of the Administration, Energy, and Minerals and Earth Sciences Programs of the organization. Under each Program is included an overview of plans and highlights of recent performance, an analysis of activity in each sector of the program, and a profile of program resources and other information. 8 figs., 45 tabs.

44386 (MEM–90-03896) **Manitoba Energy and Mines annual report, 1988-89.** Manitoba Dept. of Energy and Mines, Winnipeg, MB (Canada). [1989]. 47p. (MICROLOG–90-03896). Source: PC Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, CAN R3C 0V8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The medium- and long-term direction of the Department of Energy and Mines, in addressing its mandate, is to ensure continuity and enhancement of future benefits from Manitoba's mineral and energy resources. During the year, these functions were carried out by four main divisions: Energy Management; Minerals; Petroleum; and Policy, Planning and Project Development, with support from the Financial and Administrative Services Division, and the Communications and Community Relations Division. The Department also has responsibility for the Oil and Natural Gas Conservation Board, and the Manitoba Energy Council, plus a number of other crown corporations and boards who issue their own separate reports. A summary of expenditures of the Department for the year is given, and the activities of the divisions and associated boards and councils are described. These include energy conservation programs for the residential, commercial, agricultural, and industrial sectors; renewable and alternative energy projects; geological exploration and research; mining and petroleum industry activities and programs; and energy and resource policy, planning and project development. 7 figs., 12 tabs.

2903 Environment, Health, and Safety

Refer also to citation(s) 43702, 43714, 43925, 43935, 44005, 44023, 44206, 44421, 44458, 44480, 44513, 44517, 44555, 44572, 44590, 45236, 45243, 45244, 45287, 45296, 45297, 45298, 45299, 45302, 45310, 45313, 45314, 45315, 45316, 45352, 45353, 45354, 45356, 45357, 45358, 45359, 45360, 45361, 45362, 45363, 45364, 45365, 45366, 45367, 45368, 45369, 45370, 45371, 45372, 45373, 45374, 45375, 45376, 45377, 45378, 45379, 45380, 45381, 45382, 45383, 45384, 45385, 45386, 45387, 45388, 45389, 45390, 45391, 45392, 45393, 45394, 45395, 45396, 45397, 45398, 45399, 45400, 45401, 45402, 45403, 45404, 45405, 45406, 45407, 45408, 45409, 45410, 45411, 45412, 45413, 45414, 45415, 45416, 45417, 45418, 45419, 45420, 45421, 45422, 45423, 45424, 45425, 45426, 45427, 45428, 45429, 45430, 45431, 45432, 45433, 45434, 45435, 45436, 45437, 45438, 45439, 45440, 45441, 45442, 45443, 45444, 45445, 45446, 45447, 45448, 45449, 45450, 45451, 45452, 45453, 45454, 45455, 45456, 45457, 45462, 45472, 45478, 45480, 45507, 45621, 45634, 45635

44387 (DOE/EH–0090-Vol.1) **US Department of Energy technical safety appraisal reference manual: Volume 1.** US-DOE Assistant Secretary for Environment, Safety and Health, Washington, DC (USA). May 1989. 217p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90014833. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Technical Safety Appraisals (TSAs) of DOE Category A reactors, high hazard nuclear facilities, and selected moderate hazard facilities are conducted. A TSA is a documented multi-disciplinary facility appraisal conducted by a team of specialists. The appraisals are conducted using a "hands-on" approach by observing both the facility configuration and the performance of routine operations. DOE 5482.1A requires that written guidance and criteria be employed to assure relevance, depth, and consistency among the TSAs. The procedures in Section 3.0 of this manual provide a portion of that guidance. The criteria against which each facility is reviewed are called Performance Objectives and Criteria and are contained in Appendix A to this manual. They include criteria representing

minimum requirements to satisfy DOE policies and contractual requirements and additional criteria that provide a framework for achieving excellence in the development and implementation of safety programs at DOE facilities. The manual is organized to describe first the administrative and managerial framework within which the appraisal activities are carried out. This is followed by a description of the preparation for the appraisal, the conduct of the appraisal and the followup activities. Finally, the functional areas examined during technical safety appraisals, and the associated performance objectives and criteria, are described. 5 figs.

44388 (DOE/EH–0090-Vol.2) **US Department of Energy technical safety appraisal reference manual: Volume 2.** US-DOE Assistant Secretary for Environment, Safety and Health, Washington, DC (USA). May 1989. 24p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90014834. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This volume and its appendices describe the basic structure and overall procedures used to assess technical safety appraisal (TSA) findings and arrive at a systematic assessment, from a management perspective, of the safety performance of Department of Energy (DOE) facilities. The methodology described herein can also be used for other evaluation activities such as functional technical safety appraisals and evaluations to support award fee determination activities. This assessment is an integrated effort to collect and analyze available management insights, performance indicators, TSA findings and other information as appropriate on a facility basis in a structured manner, in order to identify facility strengths and weaknesses. This assessment and evaluation process is used by DOE management to synthesize its observations of and insights into a facility's performance and to identify the primary reasons for the appearance of common themes or symptoms. As such, DOE needs to recognize and understand the reasons for a facility's strengths as well as weaknesses. This process is intended to be sufficiently diagnostic to provide a rationale for allocating resources and to provide meaningful feedback to facility managers through appropriate field office management. 1 fig.

44389 (ETDE-IT–90-38) **The New Italian energy plan: Assessing the effects of different regulatory scenarios on the reduction of air pollutant emissions generated by fossil fuels.** Pinchera, G.; Cirillo, M.C.; Bocola, W.; Gaudioso, D. ENEA, Rome (Italy). May 1989. 11p. (CONF-8905340–1: RISO international conference on environmental models: Emissions and consequences, Riso (Denmark), 22 May 1989). Order Number DE90514425. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at RISO international conference on environmental models: Emissions and consequences (Riso, 22-25 May 1989).

The effectiveness of various regulations in reducing major air polluting emission is examined, according to the projected consumption of fossil fuels reported in the Italian National Energy Plan. The analysis is performed by implementing twenty regulatory scenarios to simulate the evolution of emissions in the years 1995 and 2000 in the main activity sectors. On the basis of the results of this simulation a preliminary estimate gives the costs associated with the reduction of emissions in the electricity generating sector.

44390 (GAO/AFMD–90-2) **Environmental and energy study conference financial statements for 1988 and 1987: Financial audit.** General Accounting Office, Washington, DC (USA). Accounting and Financial Management Div. Oct 1989. 10p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report audited the balance sheets of the Environmental Study Conference as of December 31, 1988 and 1987, and the related statements of operations and fund balance and cash flows for the years then ended. In this report's opinion, the financial position of the Conference as of these dates, and the results of its operations and its cash flows for the years then ended in conformity with generally accepted accounting principles.

44391 (GAO/AFMO–89-2) **Environmental and energy study conference financial statements for 1987 and 1986: Financial audit.** General Accounting Office, Washington, DC (USA). Accounting and Financial Management Div. Feb 1989. 9p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses the Environmental and Energy Study Conference which is a legislative service organization sponsored by a group of congressional members who pool their resources to pursue a common legislative goal. It operates as an extension of the participating members' individual offices and coordinates their efforts for reasons of efficiency and effectiveness. Its purpose is to provide its congressional sponsors with information.

44392 (GAO/RCED–89-23) **Environmental protection: Bibliography of GAO documents January 1985 - August 1988.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Feb 1989. 254p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This paper includes information of GAO documents released between January 1985 and August 1988 that directly or indirectly relate to environmental protection.

44393 (PB–90-215120/XAB) **CERCLIS tape documentation.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 1990. 76p. Source: NTIS, PC A05/MF A01.

For system on magnetic tape, see PB–90-591310.

The report is the documentation for the file on potentially hazardous waste sites that have been reported to the Environmental Protection Agency by States, Municipalities, Private companies or private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended.

44394 (PB–90-591310/XAB) **CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) site location extract. Data file.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 1990. mag ta Source: NTISSubscription.

Supersedes PB–88-914800. See also PB–90-591300. Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products. Price include documentation, PB–90-215120. Available on subscription, NAC price $880/yr; individual issue $220; all others write for quote. Issued quarterly.

The file contains data on potentially hazardous waste sites that have been reported to the Environmental Protection Agency by States, Municipalities, Private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended. The file contains information on the name and alias names, location, and indicators for National Priority status and Federal Facility.

44395 **Superfund '88.** 659p. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

These proceedings document the 9th national conference sponsored by the Hazardous Materials Control Research Institute, which was held in Washington, D.C. on November 28-30, 1988. The proceedings include the most up-to-date technical developments, the impact of federal and state policies as well as the legal, health, and economic issues that emanate from the Superfund program. The proceedings include 125 papers and seminar outlines that emphasize the latest developments and cumulative experiences gained from the spectrum of Superfund activities.

44396 **Extremely hazardous substances - superfund chemical profiles.** 1799p. Noyes Publications, Park Ridge, NJ (US) (1989).

From review in BioCycle, 30, No. 5 (May 1989).

A chemical profile is presented for each of the 366 chemicals categorized as extremely dangerous substances by the EPA and profiled in its 1988 publication. In addition to providing information on chemical identity, each profile deals with the following: (1) regulatory information; (2) physical and chemical characteristics; (3)

health hazard data; (4) fire and explosion hazard data; (5) reactivity data; (6) use information; (7) precautions for safe handling and use; (8) protective equipment for emergency situations; and (9), emergency treatment information. Several profiles also include an emergency first aid treatment guide geared to use by first responders, and based on information gained from the proprietary data-base of the Rocky Mountain Poison Center.

44397 Conducting remedial investigations and feasibility studies under CERCLA. Golian, S.C. (Environmental Protection Agency, Washington, DC (USA)); Dodge, E.E.; Bixler, B. pp. 1-4 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The US EPA is revising its guidance for conducting RI/FS to (1) reflect the new emphasis and provisions of CERCLA reauthorization; (2) incorporate management initiatives designed to streamline the RI/FS process; and (3) reflect experience gained by the CERCLA program over the past seven years. Many of these new revisions to the RI/FS process are not only necessary to comply with various CERCLA provisions, but also to ensure that these investigations are conducted efficiently and enable the Agency to meet its mandatory schedules. The purpose of this paper is to summarize the key activities for each phase of the revised RI/FS process.

44398 Selection of remedy: Changes in the remedy selection process and expectations under the Superfund Amendments and Reauthorization Act. Hanson, B. (Environmental Protection Agency, Washington, DC (USA)); Sladek, S.J.; Shaw, E.A. pp. 5-7 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

SARA, which amended CERCLA, contains a new Section 121 which establishes the mandates and criteria for selection of remedial actions. This paper describes the process established by the US EPA to fulfill the mandates of Section 121 and the EPA's guiding principles and expectations for the selection of fund-financed and enforcement remedial response actions taken under CERCLA as amended by SARA.

44399 Superfund compliance with applicable or relevant and appropriate requirements. Stone, M.E. (Environmental Protection Agency, Washington, DC (USA)); Weissman, A.B. pp. 8-11 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The 1986 Amendments to CERCLA mandated that Superfund cleanups meet applicable or relevant and appropriate requirements (ARARs),in Federal and State laws. This paper describes the basic statutory provisions for ARARs and the US EPA policies on compliance with ARARs. It discusses several examples of issues and complexities that arise in interpreting and applying the ARARs provision, including US EPA's policy on MCLs and MCLGs as ARARs for groundwater cleanup, RCRA ARARs policies, and State ARARs. 8 refs.

44400 The impact of land disposal restrictions on superfund response actions. Offutt, C.K. (Environmental Protection Agency, Washington, DC (USA)). pp. 12-14 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Superfund remedial and removal actions involve the cleanup and disposal of substantial amounts of hazardous materials which may be impacted by the Land Disposal Restrictions under the Hazardous and Solid Waste Amendments of 1984. Response actions must meet applicable or relevant and appropriate requirements (ARARs) for cleanup. When the selected remedy involves placement of hazardous wastes, the ARARs may include BDAT treatment standards under the Land Disposal Restrictions. A frequent concern at Superfund sites is contaminated soil or debris, some of which was granted a statutory exemption from Land Disposal Restrictions until Nov. 8, 1988. EPA intends to develop separate treatment standards for soil and debris because BDAT treatment standards do not generally take into account the heterogeneity of the matrix of soil or debris; the variations in composition or concentrations of the contamination; or the interferences of the matrix in the treatment process. If the remedy involves placement of contaminated soil or debris, then a treatability variance may be needed and EPA has developed interim treatment ranges for soil and debris treatability variances. 2 tabs.

44401 New superfund management initiatives for the remedial program. Nadeau, P.F. (Environmental Protection Agency, Washington, DC (USA)). pp. 15-18 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In response to persistent criticism regarding the slow pace of the Superfund Remedial Program, the US EPA has initiated numerous actions to improve Program performance. Specific actions described in the paper include: expanded project delivery mechanisms, improvement of the RI/FS process, Remedial Design/ Remedial Action initiatives and State Program Development. The common goal of these actions is to accelerate the pace of the Remedial Program and maintain control of project costs while ensuring the protection of human health and the environment through effective, high quality response actions.

44402 The US EPA's approach to evaluating and cleaning up ground-water contamination at superfund sites. Haley, J.L. (Environmental Protection Agency, Washington, DC (USA)); Lang, D.J.; Herrinton, L. pp. 19-22 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The US EPA's approach for developing, evaluating, and selecting groundwater response actions at Superfund sites with contaminated groundwater involves a series of key decisions to support necessary actions. These actions include the following: Planning how the site will be managed; Determining data needs; Determining remedial action objectives; Developing alternatives; and Selecting and implementing the remedy. The key decisions should reflect a policy and decision-making approach developed within the framework of CERCLA as amended by SARA and program policies to implement these acts. This paper outlines a flexible, iterative process, described in detail in the Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, by which groundwater remedies can be identified, evaluated, selected, and implemented at Superfund sites beginning with initial site investigation tasks and ending with evaluation of implemented actions. Proper consideration of the factors presented in this paper should result in an efficient, effective procedure for making remedial action decisions for contaminated groundwater that ensures protection of human health and the environment.

44403 Structured settlements: A new settlement incentive. Mason, R.J. (Environmental Protection Agency, Washington, DC (USA)); Johnson, M.F. pp. 23-31 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The purpose of this paper is to present the results of a US EPA study on the ability of alternative cleanup financing mechanisms to promote settlements with potentially responsible parties (PRPs) under the Comprehensive Environmental Response, Compensation, and Liability Act as amended (by SARA). To provide PRPs with an additional incentive to settle, EPA may encourage PRPs to use alternative mechanisms to finance their CERCLA settlement obligations. The EPA study identified alternative financing mechanisms that showed potential for promoting CERCLA settlements. EPA qualitatively evaluated the identified financing mechanisms with respect to key settlement funding issues. The evaluation narrowed the remainder of the research to a single financing mechanism that demonstrated the highest potential for inducing PRP settlement.

The study found that structured settlements demonstrated the highest potential as an incentive to promote PRP settlements with EPA. The study also quantitatively evaluated structured settlements to confirm the key attractions of structured settlements. This paper discusses the major findings of the study, the structured settlement concept, and how structured settlements can benefit both EPA and PRPs and facilitate CERCLA settlements. 19 refs., 6 tabs.

44404 Setting removal program priorities. Burgan, K. (Environmental Protection Agency, Washington, DC (USA)); Engelbert, B.; Montgomery, V. pp. 32-34 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Each year over 8,000 hazardous substances releases occur in the United States. The vast majority of these are cleaned up by the responsible parties or state and local governments. The US EPA has a program to assist with, or assume the lead in, responding to a limited number of complex or nationally significant incidents. The budget for this activity is remaining stable. At the same time, response costs are increasing as a result of stricter disposal regulations and more frequent use of sophisticated technologies. Consequently, program officials face increasingly tough decisions about where to become involved. This paper provides an overview of the Federal emergency response program and explains the priorities that have been set for removal activities.

44405 Practical guidance to expedite and prepare superfund studies. Pimentel, E. (Camp Dresser and McKee Inc., San Francisco, CA (USA)). pp. 35-36 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Superfund requires the preparation of a Feasibility study (FS) for each hazardous waste site on the US EPA NPL. These documents are the basis for the record of decision (ROD), the document detailing the proposed alternative to remediate an NPL site. These documents must be prepared in accordance with SARA, CERCLA, and the National Contingency Plan (NCP). Notably, several hundred FSs, must be completed in order to address the hundreds of NPL sites present nationwide. Guidance documents exist which detail how to comply with the regulatory requirements. The remedial investigation (RI) is the technical support document for the feasibility study, yet often basic planning on what type of data are necessary and how these data will be directly applied in preparing the FS is not adequately considered. This seminar discusses key issues relative to data acquisition, analysis, and presentation in the RI for use in the FS. Issues such as volume estimates on the basis of risk or regulations, classification of waste for disposal or treatment, and guidance on developing assumptions to deal with data gaps are discussed. SARA mandates that an initial screening process of potential remedial alternatives be performed. This phase necessarily requires an early review of technologies and determination as to which technology fits into a conceptual remediation plan. Innovative technologies are strongly considered if they offer potential for improved performance or implementability, have fewer adverse short- or long-term impacts, and offer the opportunity for a permanent solution. Practical guidance will be provided in this seminar on how to determine effectiveness and implementability as well as how to screen out a technology which is so initiative that cost data are highly unreliable. A technology that is not considered demonstrated may be rejected, yet guidance under Superfund defining demonstrated is minimal. 2 refs.

44406 Complying with the notification requirements under CERCLA and SARA for releases of hazardous substances. Riley, J. (Environmental Protection Agency, Washington, DC (USA)); Hostage, B.; Vega, I. pp. 37-38 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The growing spotlight on emergency response to hazardous substance releases makes knowledge of release notification requirements increasingly important to the regulated community and the government. This seminar explains release reporting obligations under section 103 of CERCLA and section 304 of SARA. Together, these two sections, and implementing regulations, establish broad and complex requirements for notifying Federal, State, and local response authorities of hazardous substance releases. 5 figs.

44407 A program optimization system for aiding decisions to fund the cleanup of hazardous waste sites at Department of Energy Defense Facilities. Merkhofer, M.W. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)); Cotton, T.A.; Longo, T.P. pp. 39-43 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This paper describes the development and application of a formal system designed to aid the Department of Energy (DOE) in allocating funds for cleaning up hazardous waste sites. The system, called the Program Optimization System (POS), is based on multi-attribute utility analysis. The POS evaluates alternative funding allocations in terms of their estimated effectiveness at achieving the basic objective. The system was developed for use by DOE's Hazardous Waste and Remedial Actions Division (HWRAD). HWRAD has responsibility for recommending Environmental Restoration (ER) activities to the Assistant Secretary of Energy. 4 refs., 3 figs., 5 tabs.

44408 A multi-attribute utility analysis model for ranking superfund sites. Call, H.J. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)); Merkhofer, M.W. pp. 44-54 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Hazard Ranking System (HRS) is a mathematical scoring model used by the US EPA to rank sites for inclusion on the NPL. In 1986, SARA required EPA to revise the HRS to ensure to the maximum extent feasible, that the ranking system accurately assesses the relative degree of risk to human health and the environment. To help evaluate the need and opportunities for improving the HRS, EPA devised the following test. The HRS and three other existing site-ranking models were used to rank 20 test sites. The rankings were then compared with a baseline ranking developed by a panel of 12 EPA technical and risk management experts. The objective was to determine which model produced results that fit the baseline best, and why. This paper describes the process used to facilitate the development of a baseline ranking of the sites by the panel. The process included the development of a multi-attribute utility analysis model for understanding the logic underlying the panel's ranking and for ranking other sites. 11 refs., 15 figs., 7 tabs.

44409 CERCLA settlement/litigation decision analysis model (SuperTree). Wright, B. (Environmental Protection Agency, Washington, DC (USA)); Fitzgerald, W.M.; DeSmidt, P.D. pp. 55-59 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In some hazardous waste cases, the United States Environmental Protection Agency (EPA) has decided that the public interest may be better served if EPA accepts settlement offers from potentially responsible parties (PRPs) rather than pursuing extended, expensive, and uncertain litigation. In most instances, settlement offers do not satisfy all the claims that EPA would have sought in court. Therefore, EPA must evaluate offers to determine when it may be better to accept an offer rather than litigate the case. EPA has developed 10 criteria to evaluate settlement offers. Six criteria weigh the economic and financial value of accepting a settlement offer today, versus receiving an uncertain court award in the future. To assist EPA in evaluating the economic trade-offs of settlement offers at Superfund sites, a decision analysis model evaluates these economic/financial criteria. A range of complex factors must be considered when deciding whether to settle or litigate a Superfund case. The decision analysis model (called SuperTree) is designed to assist EPA and Department of Justice decision-makers

by providing an explicit quantitative and analytical format for evaluating settlement offers at particular sites. SuperTree is designed to measure the economic trade-offs of Superfund settlement offers. Decision-makers must consider factors including financial outcomes, the time value of money, the risk of legal reversals, and the uncertainties inherent in hazardous waste litigation. The major benefit of decision analysis is that it offers the decisionmaker a framework to evaluate a complicated decision problem. The decision-maker examines the interactions of each economic/financial dimension of the case. SuperTree is an analytical model for systematic evaluation of the factors which influence decisions and resulting outcomes and allows for a range of assumptions to be entered and analyzed. 6 refs., 3 figs.

44410 Implications of dealing with real estate-based cleanup statues and recommended measures for avoiding economic and operational disruption. Greenthal, J.L. (Nixon, Hargrave, Devans and Doyle, Albany, NY (USA)); Millspaugh, M.P. pp. 60-64 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Current statutory coverage relative to hazardous chemicals' and petroleum products extends primarily to hazardous waste disposal sites and oil spills. Frequently overlooked are industrial facilities where, in the normal course of operation (as distinguished from facilities engaged in the handling and management of hazardous waste), spills and leaks of chemicals and petroleum products have occurred. Government is now seeking to add to its arsenal of authority by developing mechanisms for addressing contamination of environmental media and man-made structures resulting from routine industrial and chemical- and petroleum-handling activities. One mechanism on which governments have begun to focus is an environmental cleanup responsibility act. Pioneered in New Jersey and currently before many other state legislatures, such a proposal seeks to impose governmental control, in the form of requiring site investigations and cleanups, at a key leverage point in commercial transactions; the moment when the facility owner attempts to relinquish dominion over the property - through closure or transfer of the facility. The impact of these legislative proposals extends beyond present traditional governmental concerns, which have centered on generators and transporters of hazardous waste and owners and operators of hazardous waste sites, to also encompass lending institutions and insurers. This paper describes the implications of this growing movement toward earlier and more pervasive requirements from both government and private economic forces on industries whose day-to-day activities will almost certainly involve spills and leaks of hazardous substances and petroleum products. Specific preventive measures are recommended that lending institutions, insurance companies and industries can undertake to lessen the financial and operational disruptions that this new, all-encompassing legislation will provoke. 20 refs., 2 tabs.

44411 Methods for conducting property transfer evaluations: Limiting liability. Duffala, D.S. (B and V Waste Management, Inc., Kansas City, MO (USA)); Boyd, K.A. pp. 65-66 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

With increasing frequency, the parties involved in commercial and industrial property transfers require an environmental audit of the property before business decisions related to the transaction can be finalized. Such audits, called property transfer evaluations (PTE), are necessary to clearly delineate potential liabilities associated with waste management practices. Since liabilities under certain environmental statues (e.g., CERCLA or SARA) can be assessed to the owner/operator of the facility, the buyer and lending institution need to assess the property for the presence of hazardous materials and wastes. This paper examines the perspectives of each involved party, including the buyer, seller, investor or financing institution, and the environmental consultant. It further describes the statutory basis for a PTE, with an explanation of potential effects on each involved party. A method description for performing a PTE is also given, and methods to limit the potential liabilities for the environmental consultant are described.

44412 Private cost recovery and contribution actions under CERCLA. Lamb, R.H. (McGuire, Woods, Battle and Boothe, Washington, DC (USA)); Jewett, J.J. III; Smart, D.A. pp. 67-71 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This paper discusses private cost recovery and contribution actions under the CERCLA and SARA. It includes a summary of the relevant legislative history of CERCLA and SARA and a review of recent case law on key issues. In addition, certain significant issues that the courts have not yet addressed are identified. 86 refs.

44413 Bioassessment: Its use and possible implications in Federal and State Superfund. Gutzmer, M.P. (Texas Water Commission, Austin (USA)); Epperson, C.R. pp. 72-76 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The presence of toxic chemicals at hazardous waste sites in the environment may adversely affect the abundance, species composition and diversity, stability, productivity and physiological condition of indigenous biota. Assessing the effects of whether toxic chemicals create an impact on flora and fauna populations in and around hazardous waste sites is known as a bioassessment. The State Superfund Program of the Texas Water Commission (TWC) uses a bioassessment in several ways: to support evidence in an administrative order under 8(g) or 13(g) of the Texas Solid Waste Disposal Act; to support the TWC's position in litigation following an appeal to court of such an administrative order; to inform the public of the effects a hazardous waste site has on organisms in the surrounding environment; to provide additional information presently not addressed in the Hazard Ranking System (HRS) regarding environmental effects: and to provide insight into a more comprehensive remedial investigation study. The Texas Water Commission conducted its first State Superfund bioassessment at the McBay Oil and Gas site. Results of sampling indicated significant differences in biotic diversity and abundance between the impacted stream and an unimpacted stream in that area. This paper will illustrate an example of present usage of bioassessment by the Texas Water Commission State Superfund Program and discuss possibilities for the federal and other state programs. 11 refs., 4 figs., 2 tabs.

44414 Co-Operative efforts of the Federal Government and states under the SITE program. Valentinetti, R.A. (Environmental Protection Agency, Washington, DC (USA)); Librizzi, W. pp. 77-78 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The principal reason that the authors received this assignment to promote a joint cooperative effort between the states and the US EPA in the SITE program is my unique position and background. They have been assigned to the US EPA under the Inter governmental Personnel Act (IPA) from the State of Vermont as the Director of the Air and Solid Waste Program that includes such activities as site cleanup as well as removal response. Under the IPA, they spent 2 yrs. with the Underground Storage Tank Program with a main focus on the development of the corrective action regulations on tanks. The remaining 2 yrs, of my IPA assignment will be associated with the Office of Research and Development to work in the SITE program. In late 1987, my co-author William Librizzi with the State of New Jersey initiated an effort within ASTSWMO to encourage greater participation for the states in the SITE effort. It was the states' desire to participate in the area of site selection for technology evaluation and help fund some research efforts. The (ASTSWMO) Technology Transfer Task Force indicated to the US EPA that the possible contribution by the states would be: providing a broader perspective in the results associated with alternative technology testing; meeting short- and long-term technology application needs; allowing a timely transfer of information on

experiences with technologies; finding solutions to permitting impediments; improving information transfer to citizens and bringing about timely delivery of program results through activities such as site selection assistance and co-funded projects.

44415 The remedial process matrix as it relates to New Jersey Department of Environmental Protection's integrated case management strategy. Grayson, L. (New Jersey Dept. of Environmental Protection, Trenton (USA)); Witt, A.; Borgianini, S.A. pp. 79-83 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Equipped with a variety of statutory mandates and corresponding operational units, New Jersey Department of Environmental Protection's (NJDEP) Hazardous Waste Management Program strives to effectively manage an ever-expanding universe of sites/facilities in need of remedial attention. To aid in the management of cleanup activities, the Department developed its integrated Case Management Strategy (CMS). The Department recognizes the importance of assuring that the sites that it addresses first are those posing the greatest risk to public health and the environment. Equally important is assuring that the operational unit assigned the lead in managing the cleanup is that unit best equipped to do so and that appropriate support functions are readily available. Maintaining consistency in technical approach is the third major goal of the Department in developing its integrated CMS. The CMS facilitates the routine advancement of sites through the remedial process from site discovery to case closeout. The strategy's framework and critical components may aid other states in organizing their efforts at site remediation. A particular component of the planning process related to the CMS is the remedial process matrix. The intent of the remedial process matrix is two-fold. First, the matrix assures that the proper remedial tools are employed for a site of a specific environmental complexity or level of effort. Second, once remedial levels are established, the use of the remedial process matrix assures that sites of similar complexity are remediated in a comparable manner so that the end results of the remedial actions are equivalent between the varied remedial programs within the Department. The CMS provides a functional framework. It lays out where potential responsibility for case management may be and includes mechanisms for site reassessment, prioritization and reassignment.

44416 Correlating gamma radiation measurements to radium concentrations in soil. Downie, A.R. (Camp Dresser and McKee, Inc., Edison, NJ (USA)); Lawson, F.D.; Miller, K.E.; Ranney, C.A. pp. 103-107 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Gamma scintillation detectors are often used to determine if radiation exposure standards are exceeded at radioactive hazardous waste sites. Measurements are generally stated in disintegrations or counts for minute (cpm) which are then converted to micro roentgen per hour (μR/hr). Soil cleanup standards for radium-contaminated hazardous waste sites, however, are measured in picoCuries of radionuclide per gram of soil (pCi/g). Conversions of μR/hr (an exposure rate) to pCi/g (actual activity per mass) can be made; however, when one is dealing with an area where contamination is irregularly dispersed throughout the soils, simple linear relationships between μR/hr and pCi/g are difficult to obtain. A series of investigations were conducted at a radioactive hazardous waste site to develop a correlation between gamma measurements and subsurface soil concentrations. Previous investigations at this site had found a poor correlation between these measurements, with a correlation coefficient (r) of only 0.661 and an r^2 of 0.45. Problems cited were inadequate sampling techniques and non-homogeneity of the waste. The present investigation sought to obtain more precise field measurements and took better care in sampling to ensure that material seen by the detector was analyzed. The gamma measurements were taken using a sodium iodide (NaI) scintillation probe with a portable fore inadequate sampling techniques and non-homogeneity of the waste. The present investigation sought to obtain more precise field measurements and took better care in sampling to ensure that material seen by the detector was analyzed. The gamma measurements were taken using a sodium iodide (NaI) scintillation probe with a portable scaler/ratemeter. Surface and subsurface soil samples taken at the same location as the surface and subsurface (borehole) gamma measurements were analyzed for radionuclide content. 6 refs., 6 figs., 1 tab.

44417 Policies to encourage private sector responses to potential climate change. Cantor, R. (Oak Ridge National Lab., TN (USA)); Jones, D.; Leiby, P.; Rayner, S. pp. 318-328 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper discusses a study conducted to encourage responses to potential climate change by the private sector using four classes of incentives. The authors identify information learned during the study about policies to deal with potential global warming.

44418 Deposit-refund systems for managing hazardous wastes produced by small businesses. Cuckovich, W.P. (Univ. of California, Davis (USA)); Schwartz, S.I. *Journal of Environmental Management (USA)*, 29(2): 145-161 (Sep 1989).

This article examines the potential of an economic incentive device virtually unused in the United States for managing hazardous wastes– deposit-refund systems. The emphasis is on reducing the high rate of illegal disposal of hazardous wastes by small firms. We give evidence that illegal disposal is a problem and identify its underlying causes, principally lack of enforcement. Theory and operation of deposit-refund systems are described, with illustrative situations showing the crucial role of the size of the refund relative to the cost of legal disposal. Economic effects, advantages, and problems of design and implementation are examined. We conclude that deposit-refund systems are potentially effective for reducing illegal disposal, and that they promote economic efficiency and equity. Pilot programs are recommended.

2904 Energy Resources

Refer also to citation(s) 44069, 44386, 44451, 44452, 44482, 44585, 44601

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 43854, 44066, 44067, 44086, 44092, 44101, 44131, 44261, 44385, 44466, 44484, 44485, 44501, 44502, 44507, 44555, 44571, 44961, 45203, 45244, 45276, 46084, 46088, 46298

44419 (BNL–44004) **[Energy resources and conversion processes]: Foreign trip report, June 4–June 15, 1988.** Steinberg, M. Sr. Brookhaven National Lab., Upton, NY (USA). 16 Jun 1988. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-76CH00016. Order Number DE90015216. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The writer was invited by the Organizing Committee to present a paper at the 2nd International Congress and Exhibition on Energy held in Tiberias, Israel, June 5–8 1988. This meeting is sponsored by the Israeli Ministry of Energy and Infrastructure in cooperation with 10 Universities and Institutes including the Israeli Electric Corporation, Ltd. It is mainly an Israeli function to have a scientific and technical exchange of information world-wide and to particularly present Israeli energy technology know-how and to display equipment at the exhibition. There were 500 persons registered for the meeting. Approximately 120 papers were presented at 5 plenary sessions and 10 parallel sessions covering most energy disciplines. Approximately 35 countries were represented. This Congress should be distinguished from the World Energy Conference (WEC) sponsored by the World Bank in conjunction with other world agencies. The last WEC Conference was held in 1986 in Cannes, France, and the next one will be held in Montreal, Canada, in 1989. Solar Energy and Coal Conversion were two major topics.

44420 (C-CORE–89-11) **The role of C-CORE in Canadian Cold Oceans Resources Development.** Clark, J. Memorial Univ. of Newfoundland, St. John's, NF (Canada). Centre for Cold Ocean Resources Engineering. [1988]. 5p. (MICROLOG–90-00377). Source: PC Centre for Cold Ocean Resources Engineering, C-CORE, Memorial University of Nfld., St. John's, NF, CAN A1B 3X5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $24.00 CAN; MF $10 CAN.

C-CORE is an organization established in 1975 to carry out research on the development of petroleum resources that lie below the seabed, in waters that are covered by or invaded by ice every year. The organization also aids in the training of students and graduates in engineering and science. While development of petroleum resources is still the single most important aspect of the Centre's research programs, much of the present day research is also relevant to the fishing industry, the transportation industry, the military, and to offshore minerals, particularly the rich placer deposits that exist in many of Canada's nearshore regions. The research program is limited to ice engineering, seabed geotechnics and remote sensing. This paper describes the organization and operation of the Centre, its methods of technology transfer and training, and its interaction with industry. 1 fig.

44421 (CONF-9007140–1) **Department of Energy national laboratories.** Trivelpiece, A.W. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Subcommittee on energy research and development committee on energy and natural resources; Washington, DC (USA); 25 Jul 1990. Order Number DE90015165. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is a transcript of the testimony of Alvin W. Travelpiece before the Congressional Subcommittee on Research and Development. Emphasis is placed on the importance of funding nuclear programs to assure national well-being; and, past accomplishments in the nuclear programs are reviewed. (FSD)

44422 (DOE/ER/75498–1) **The Government-University-Industry Research Roundtable 1989 annual report.** Government-University-Industry Research Roundtable, Washington, DC (USA). Feb 1990. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER75498. Order Number DE90015423. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Established six years ago to test a new approach to science and technology policy, the Government-University-Industry Research Roundtable now is widely recognized as the facilitator of dialogue that injects imaginative thought into the policy process and more effective procedures into the nation's research system. Two challenges face the Research Roundtable as it evolves into an established institution. The Roundtable must maintain the vitality of a young and innovative enterprise, and it must develop a stable long-term funding base. Progress was made on both fronts in the past year. Two major discussion papers were established in 1989. Both are outgrowths of extensive work over several years and, in keeping with the Roundtable's mission as an organization that gives ongoing attention to complex, controversial, and often intractable issues, both are vehicles for follow-on activities. Science and Technology in the Academic Enterprise: Status, Trends, and Issues analyzes the current research system and identifies emerging trends and major issues to be addressed in considering its future. As planned, the paper is stimulating debate within the research community and is being used as a platform for the examination of options and scenarios for the future of the enterprise. Perspectives on Financing Academic Research Facilities: A Resource for Policy Formulation, designed to inform the national debate on facility financing, has provided the background for a series of workshops in which the federal government, universities, and the states each articulate options for their sector to pursue in funding academic research facilities. The statements will be used as a basis for working toward a comprehensive approach to the problem–an approach involving all sectors and range of funding mechanisms.

44423 (EMR/V/CRE–CE02911, pp. 103-125) **Hydraulic energy research and development program: Future possibilities evolving from Small hydro Canada '87.** Cole, J. (Solar Energy Div., Energy Mines and Resources Canada, Ottawa, ON (Canada)); Tung, T. Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper is a brief description of the Federal Renewable Energy Research and Development Program, its policy, management and funding resources, with the primary focus being on hydraulic energy (mainly small-scale and low-head hydro). The funding levels for 1986/87 and 1987/88 have been set for approximately Can $6 million per year, distributed amongst the following areas: active solar, passive solar, photovoltaic, hydraulic, wind, and geothermal. The objective of the hydraulic energy program is to develop new technologies and improve the existing ones in order to increase the economic viability of selected small-scale or low-head hydro, including tidal energy generation options. The strategy, achievements and priorities of the hydraulic energy program are discussed. More than 20 small hydro demonstration projects have been completed since 1980, and progress has been achieved in the fields of water resource assessment, development of new hydraulic turbines (including a Darrieus-type vertical axis turbine), pre-fabricated power station packages, innovative civil structure arrangement and construction, and standardized electrical generation and automatic control equipments. The future directions of research are listed. 13 tabs.

44424 (ETDE-IT–90-53) **ENEA (Italy) transfer of nuclear power plant technological innovations to industry.** ENEA, Rome (Italy). Direzione Centrale Relazioni. Jan 1989. 74p. (In Italian). Order Number DE90514528. Source: NTIS (US Sales Only), PC A04/MF A01.

This paper summarizes the technology transfer program activities and results obtained by the Thermal Reactor Dept. of ENEA (Italian Commission for Alternative Energy Sources). An assessment is made of light-water reactor technological innovations and their possible industrial applications. The reactor R&D programs concerned improvements in the following areas: steam generators, primary cooling circuit pumps, fuel additives, vessels, feedwater preheaters, turbine/alternator sets, steam separators, monitoring, safety and control equipment, welding techniques, corrosion protection, etc. The technological tools developed, and whose application is being considered for industry, are: computer aided design, new computer architecture, expert systems digital image processing, process control systems, etc.

44425 (ETDE-IT–90-55) **ENEA/Italian industry coordinated R&D in the thermo-electromechanical sector: 1983/87 program results.** Ferrari, G. (ed.). ENEA, Rome (Italy). Direzione Centrale Relazioni. Nov 1988. 111p. (In Italian). Order Number DE90514529. Source: NTIS (US Sales Only), PC A06/MF A01.

The R&D activities of ENEA (Italian Commission for Alternative Energy Sources) have been set up in such a way as to involve cooperation by Italian industry and eventual transfer of nuclear technological innovations to the conventional power plant sector. This paper reports on the main technological spin-offs derived form the Thermal Cycle project during the years 1983 to 1987. The activities were directed towards the following power plant components and aspects: steam separator/reheaters, condensers, cooling towers, modular process units, combined cycles. The new technological tools developed involved mainly new materials working techniques process computer codes, on-line control systems and expert systems.

44426 (ORNL–6627) **Energy Division annual progress report for period ending September 30, 1989.** Selden, R.H. (ed.). Oak Ridge National Lab., TN (USA). Jun 1990. 202p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90014766. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

The Energy Division is one of 16 research divisions at Oak Ridge National Laboratory. The goals and accomplishments of the Energy Division are described in this annual progress report for Fiscal Year (FY) 1989. The Energy Division is a multidisciplinary

research organization committed to (1)increasing the knowledge and understanding of how societies make choices in energy use, (2) improving society's understanding of the environmental implications of technological change, (3) improving and developing energy efficient technologies, and (4) improving and developing transportation planning and scheduling systems. The Energy Division's programmatic activities focus on three major areas: (1) analysis and assessment, (2) energy conservation technologies, and (3) transportation systems. Analysis and assessment activities cover energy and resource analysis, the preparation of environmental assessments and impact statements, research on waste management, analysis of emergency preparedness for natural and technological disasters, and analysis of the energy and environmental needs of developing country. Energy conservation technologies include heat pumps (thermally activated, electric driven, and chemical), building envelopes (walls, foundations, roofs, and materials), retrofits for existing buildings, and electric power systems. Transportation systems concentrate on research for sponsors within the US military on improving the efficiency of military deployment, scheduling, and transportation coordination. Research on transportation analysis is conducted for civilian sponsors on a variety of issues. 415 refs., 67 figs., 21 tabs.

44427 (PNL-SA-17857) **The technology transfer process: Background for the National Energy Strategy.** Deonigi, D.E.; Moore, N.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 18p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-76RL01830. (CONF-9006221--3: Annual technology transfer society meeting, Dayton, OH (USA), 26 Jun 1990). Order Number DE90015301. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is based on our White Paper, which was background for the technology transfer section of the US Department of Energy's (DOE) National Energy Strategy (NES), and a subsequent survey, which was conducted to characterize the technology transfer programs throughout DOE. From 172 selected technology transfer case studies, Pacific Northwest Laboratory characterized DOE's 7 major programs. This paper describes the objectives, strategies, and mechanisms that DOE and its laboratories use in their technology transfer programs. Technology transfer is defined for the purposes of this paper as the process by which technology, knowledge, and/or information developed in one organization, in one area, or for one purpose is applied and used in another organization, in another area, or for another purpose. The end user may be the public, industry, another federal laboratory, or any other technology developer. Technology information can be a simple energy conservation practice for public use, databases, a patent of an invention, a report on the properties of a magnetic field, an improved industrial process, or a new procedure for handling a hazardous material. Some technologies are identified as potential commercial successes and are transferred to the private sector early in the development process; other technologies are not transferred until they are fully developed and tested. Mechanisms to facilitate technology transfer by providing feedback from the end user to the developer, such as advisory groups with potential users as members, tend to be effective ways to accelerate transfer and technology utilization. 9 figs.

44428 (UCRL-53859-89) **Energy program annual report.** Borg, I.Y. (ed.). Lawrence Livermore National Lab., CA (USA). Jul 1990. 52p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; U.S. DOE Fossil Energy; U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. Order Number DE90014825. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report presents on overview of research from Lawrence Livermore laboratories on the following topics: fossil energy; petroleum geochemistry: origin of oil and gas; methane-conversion enzymes; oil shale project; flow of granular solids; mild coal gasification; and injection-front imaging in enhanced oil recovery. Conservation and renewable energy: geothermal program and combustion technology. Nuclear waste: high-level nuclear waste disposal. hazardous waste research & development.

2906 Nuclear Energy

Refer also to citation(s) 43776, 44019, 44256, 44257, 44421, 44450, 44480

44429 (GAO/GGD-89-117) **Tennessee Valley Authority: Special air transportation services provided to manager of nuclear power.** General Accounting Office, Washington, DC (USA). General Government Div. 1989. 13p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report examines the purpose, nature, and costs of the Tennessee Valley Authority's provision of special air transportation services to TVA's manager of nuclear power. It has been found that TVA spent $172,700 to fly him between his TVA office in Chattanooga, Tennessee, and his home in Charlottesville, Virginia, between October 1987 and September 1988. He was accompanied by his wife on three flights during this period. TVA provided that transportation as part of its management services contract with the manager's personal services corporation. Of the $172,700 TVA spent for the special flight arrangements, $126,500 was for the cost of home-to-work transportation services provided directly to him and, in three instances, to his wife. According to this report, the fair market value of those services - not necessarily the $126,500 that TVA paid for them - could be considered taxable compensation.

44430 (IAEA-TECDOC-541, pp. 97-100) **Potential areas of R and D activities in the framework of international co-operation related to advanced nuclear technologies.** Dekeyser, J. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The Belgian nuclear background and its relation towards the international nuclear community are first reviewed. A survey is then given of the strong lines of the national nuclear industry and of the research potential of Belgium with respect to advanced nuclear power technologies and some non-energy applications. Finally, a number of attractive areas for Belgian international co-operation in research and development, related to advanced nuclear power technology, are briefly discussed. (author).

44431 (IAEA-TECDOC-541, pp. 101-105) **Multicriteria decision analysis for nuclear technology assessments.** Kunsch, P.L. (Belgatom S.A., Brussels (Belgium)). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The paper presents the nuclear services of BELGATOM, an architect and consulting engineering company, in particular the use of decision tools for further studies on the introduction of advanced nuclear technologies. These decision tools are based on Multiple Criteria Decision Analysis (MCDA) and its purpose is to assist the decision makers in either selecting "good" solutions or in ranking alternatives in presence of several decision criteria. This MCDA can be applied in any field such as personnel management, site selection, R and D, capital budgeting, energy management etc. BELGATOM has also developed its own tools called STRANGE (Strategy for Nuclear Generation of Electricity) for solving the strategic problems such as fuel cycle optimizations, reactor deployment etc. (author). 2 figs.

44432 (ORNL/NSP-90/7) **KWOC [Key-Word-Out-of-Context] index of nuclear energy standards.** Jennings, S.D. Oak Ridge

National Lab., TN (USA). May 1990. 55p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90014768. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

One major task of the Nuclear Standards Program funded by the Department of Energy (DOE)-Nuclear Energy (NE) Technology Support Programs is to promote and support the use of standards by providing line managers and standards coordinators with data that facilitates their ability to utilize standards requirements. To meet this task, the Performance Assurance Project Office (PAPO) administers a Performance Assurance Information Program. The task is carried out in accordance with the principle set forth in DOE Order 1300.2, "Department of Energy Standards Program," December 18, 1980, and DOE memorandum, "Implementation of DOE Orders on Quality Assurance, Standards, and Unusual Occurrence Reporting for Nuclear Energy Programs," March 3, 1982, and with guidance from the DOE-NE Technology Support Programs. The purpose of this information program is to collect, compile, and distribute program-related information, reports, and publications for the benefit of the DOE-NE program participants.

44433 (UCRL–101627) **Designing effective protection against threats at nuclear facilities.** Cummings, G.E.; Al-Ayat, R.A. Lawrence Livermore National Lab., CA (USA). Jul 1989. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907103–13: Conference on technology-based confidence building: energy and environment, Santa Fe, NM (USA), 9-14 Jul 1989). Order Number DE90015191. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

To build confidence in the viability of nuclear fission power, the public and governmental agencies must be assured that facilities handling nuclear material are adequately protected against a spectrum of hypothesized threats and their potential consequences. Not only must the protection be adequate, but it must be perceived to be adequate by the public. Moreover, facilities must demonstrate that these systems are implemented in a cost-effective manner. No matter what reactor design or fuel cycle is used, certain of these threats must be considered, e.g., earthquakes and therefore it is important that methods be developed to ensure adequacy of protection. Such threats are being studied on an international basis with guidance being developed by the International Atomic Energy Agency (IAEA) and confidence in their use is being built through information exchange at various bi-lateral and multi-lateral conferences. As an example of how such threats are considered, we will focus on two types of threats: the threat of a malevolent act such as theft or sabotage, and the threat from natural or man-made hazards such as earthquakes and fires. The former threat is, of course, a safeguards concern while the latter is a safety issue. This paper is divided into two parts. In the first we describe the analytic tools we're developing to assist in designing cost-effective protection against malevolent acts. In the second part we provide example approaches for performing risk assessments for external events. 6 refs.

44434 **S. 589: A Bill to amend the Energy Reorganization Act of 1974 to create an Independent Nuclear Safety Board. Introduced in the Senate of the United States, One Hundredth Congress, First Session, March 15, 1989.** 11p. Government Printing Office, Washington, DC (US) (1989).

Senate Bill S. 589 amends the Energy Reorganization Act of 1974 and creates an independent Nuclear Safety Board. The makeup of the Board is set forth and its duties are listed as: (1) to conduct independent investigations of events at facilities, or involving materials, licensed or otherwise regulated by the Nuclear Regulatory Commission (NRC); (2) to review and assess the licensing and other regulatory practices of the NRC; (3) to recommend to the NRC improvements in licensing and related regulatory practices; and (4) to inform Congress of its investigation findings and recommendations. The Board is to be terminated at the end of fiscal year 1995, and appropriations for each of the intervening fiscal years is set by the Bill at $6 million. The Bill was referred to the Committee on Environment and Public Works after introduction and two readings in the Senate.

44435 **Waste Isolation Pilot Plant Land Withdrawal Act of 1988.** 46p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Energy and Natural Resources reports on the Bill S. 1272 and recommends passage of the bill as amended by the Committee. S. 1272 as amended withdraws 10,240 acres of land in Eddy county, New Mexico for the exclusive use of the Department of Energy (DOE) for construction, operation, decommissioning and post-decommissioning control of the Waste Isolation Pilot Plant (WIPP). The lands, currently managed by the Department of the Interior, would be permanently withdrawn and transferred to the control of DOE. The bill sets forth specific instructions to the Secretary of Energy to preserve the ecology of these lands and mandates compliance with standards of the Environmental Protection Agency (EPA) for storage and disposal of transuranium radioactive waste as set forth in 40 C.F.R. Part 191. In addition to the section-by-section analysis of the bill, a cost estimate from the Congressional Budget Office and copies of communications received by the Committee from DOE and the Department of the Interior setting forth executive recommendations relating to the bill are included.

44436 **Proposal to enter subsequent arrangement under the Atomic Energy Act. Communication from The Assistant Secretary of Energy for International Affairs and Energy Emergencies. One Hundredth Congress, Second Session.** House Document 100-231. 35p. Government Printing Office, Washington, DC (US) (1988).

A proposal to the Atomic Energy Act of 1954 is recorded that would permit Japan to receive plutonium being returned from France or the United Kingdom after reprocessing of irradiated reactor fuel from Japan by sea transport. The implementing agreement provides only for the air shipment of plutonium. The agreement has been approved by the Executive Branch, the Department of Defense, and the Secretary of Energy, and it is judged that this agreement will not result in a significant increase in the risk of proliferation. This analysis of the proposal was submitted to the Committee on Foreign Affairs of the House of Representatives.

44437 **H.R. 5022: A Bill to provide jurisdiction and procedures for claims by individuals for injuries or death due to exposure to radiation from nuclear testing. Introduced in the House of Representatives, One Hundredth Congress, Second Session, July 12, 1988.** 9p. Government Printing Office, Washington, DC (US) (1988).

The bill H.R. 5022 introduced in the House of Representatives provides jurisdiction and procedures for claims by individuals for injuries or death due to exposure to radiation from nuclear testing. The act is to be cited as Radiation Exposure Compensation Act. The bill sets forth the events leading to exposure and lodges the jurisdiction over the claims with the United States Claims Courts. Criteria are set forth for determination of damage for claims. The bill was referred to the Committee on the Judiciary.

44438 **H.R. 5181: A Bill to provide for the establishment of a uranium enrichment corporation, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, August 8, 1988.** 53p. Government Printing Office, Washington, DC (US) (1988).

H.R. 5181 is a bill to provide for the establishment of a uranium enrichmen corporation, which will be an efficient provider of uranium enrichment services able, insofar as is consistent with maximizing the value of the corporation, to meet the needs of the United States for uranium enrichment services, and which will be suitable for eventual transfer to private ownership. Other aspects of the bill assure the recovery of the value of assets transferred to the corporation, maximize the value of the corporation to the United States, assure the recovery of the costs for decommissioning existing and future uranium enrichment facilities owned by the corporation, and prevent any further public subsidization of the Civilian Uranium Enrichment Program in the United States. After introduction, the bill was referred jointly to the Committees on Energy and Commerce and Interior and Insular Affairs.

44439 **Uranium Mill Tailings Remedial Action Amendments Act of 1988. Introduced in the Senate, One Hundredth**

Congress, Second Session, Report 100-543, September 23, 1988. Calendar No. 984. 13p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Energy and Natural Resources reported favorably on the Uranium Mill Tailings Remedial Action Amendments Act of 1987 (S.1991) with some amendments, the principal one being to change the 1987 date to 1988. The purpose of this bill is to authorize the Secretary of the Interior to transfer lands under the jurisdiction of the Bureau of Land Management to the Department of Energy for permanent surveillance and maintenance of remediated mill tailings as required by the Uranium Mill Tailings Radiation Control Act of 1978. The bill also extends the authority of the Secretary of Energy to perform remedial action at designated uranium mill tailings sites and vicinity properties until 30 September 1994. The authority to perform groundwater restoration activities is extended without limitation.

44440 Granting the consent of the Congress to the Southwestern Low-Level Radioactive Waste Disposal Compact Consent Act. Introduced in the House of Representatives, One Hundredth Congress, Second Session, Report 100-931, Part 1, September 16, 1988. 7p. Government Printing Office, Washington, DC (US) (1988).

The Committee on Interior and Insular Affairs recommended passage of H.R. 5232. This bill grants the consent of the Congress to the Southwestern Low-Level Radioactive Disposal Compact. The Committee report includes a brief background of the problem of low-level radioactive waste disposal, particularly, as addressed in the Low-Level Radioactive Waste Policy Act, Public Law 96-573 passed in 1980. The history of the Southwestern Compact developed to address the Waste Policy Act is discussed. The conditions of Congressional consent to the compact and the need for the legislation are set forth. A section-by-section analysis of the bill is included.

44441 H.R. 4806: A Bill establishing a system of compensation for individuals harmed by nuclear testing, and for other purposes. Introduced in the House of Representatives, One Hundredth Congress, Second Session, June 14, 1988. 18p. Government Printing Office, Washington, DC (US) (1988).

Bill H.R. 4806 introduced into the House of Representatives establishes a system of compensation for individuals harmed by nuclear testing and is cited as the Atmospheric Nuclear Testing Compensation Act. The bill specifically aims at compensating persons alleging exposure to radiation from the open-air atomic bomb tests conducted at the Nevada test site during the period 1 January 1951 to 31 July 1962 and at uranium miners alleging exposure to ionizing radiation working in a uranium mine in Colorado, New Mexico, Arizona, or Utah during the period 1 January 1947 to 31 December 1961. The bill establishes a Commission to carry out the purposes of this act, sets forth the powers of the Commission, and spells out its administrative functions and other duties. A trust fund of $150,000,000 is established by the bill, and rules are set forth for assessing claims. The bill was referred jointly to the Committees on Energy and Commerce and the Judiciary.

44442 OTA Magnetic Fusion Report Starpower. Hearing before the Subcommittee on Energy Research and Development and the Subcommittee on International Scientific Cooperation of the Committee on Science, Space, and Technology, House of Representatives, One Hundredth Congress, First Session, October 28, 1987. 85p. Government Printing Office, Washington, DC (US) (1987).

Results of the hearings before the joint meeting of the Subcommittee on Energy Research and Development and Subcommittee on International Scientific Cooperation of the Committee on Science, Space, and Technology of the House of Representatives to hear testimony on the recently released report of the Office of Technology Assessment (OTA), Starpower, dealing with the US and international quests for fusion energy are reported. The report discusses the key elements that make for a strong domestic program as well as important aspects of international cooperation in magnetic fusion. The important place of the Compact Ignition Tokamak in the domestic fusion energy program is emphasized. The Starpower report indicates that there is no foreseeable energy crisis and, therefore, this is an excellent time to take steps to develop an alternate energy source. It is pointed out in the discussion that billions of dollars are being spent on fusion energy, but that private industry does not see any possibility of profit available for 2 or 3 decades.

44443 Radon exposure: Human health threat. Hearing before the Subcommittee on Health and the Environment of the Committee on Energy and Commerce, House of Representatives, One Hundredth Congress, First Session on H.R. 2837. Serial No. 100-132. 145p. Government Printing Office, Washington, DC (US) (1988).

The hearings on H.R. 2837 that amends the Toxic Substance Control Act to assist states in responding to the threat to human health posed by exposure to radon were held by the Committee on Energy and Commerce, Subcommittee on Health and Environment chaired by Hon. Henry A. Waxman. Testimony was presented by the Environmental Protection Agency Deputy Administrator and a number of other outstanding witnesses representing state governments, health organizations, homebuilders, and environmental groups. The bill is recorded in its entirety and provides for both technical and financial assistance to the states for the enactment and execution of radon testing programs.

2908 Heat Utilization

Refer also to citation(s) 43872, 44578

44444 (OME–90-01732, pp. 1-11, Paper 1) **[Energy efficiency in Ontario].** Crosbie, D.A. (Ontario Ministry of Energy, Toronto, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The federal government is committed to deregulating oil and gas markets, and to implementing a Free Trade Agreement with the United States. Both of these factors will make energy markets in North America even more competitive. Ontario is Canada's largest energy market, whose only major indigenous energy is electricity. Electricity demand is forecast to grow by about 2.5%/y until the year 2000. Since the recession, demand growth has averaged about 4.5%/y. Major new sources of supply to meet this demand are expensive and controversial. Cogeneration can be a clean, efficient and competitive alternative. It takes advantage of a proven technology, where the costs and paybacks are well-known. Cogeneration plants can be built all across the province, often as an add-on to existing plants, and they can be tied into transmission lines. It should also be noted that the economic activity they create is spread out more evenly across the province. Although the Ministry of Energy has not yet introduced an encouragement program aimed specifically at cogeneration, they are helping some Ontario companies with the costs of assessing the potential for cogeneration in specific operations. The ministry believes that cogeneration is the single most important factor that can help improve Ontario's industrial competitiveness due to its strong economic benefits and major improvements in operational efficiency.

2910 Conservation

Refer also to citation(s) 44086, 44426, 44451, 44494, 44502, 44507, 44513, 44515, 44517, 44526, 44553, 44572, 44584, 44589, 45039

44445 How far can the world get on energy efficiency alone. Katzman, M. (Oak Ridge National Lab., TN (USA)). pp. 387-398 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper discusses studies conducted to examine whether or not the industrial world can maintain a high standard of living by pursuing a path of energy efficiency. The author interprets the issues presented and suggests that greater energy efficiency is not an end in itself but a means of improving wellbeing.

44446 Predicting air conditioner load curves from energy audit data: A comparison of predicted and actual air conditioning data from the Athens load control experiment. Reed, J.H. (Oak Ridge National Lab., TN (USA). Energy Div.); Broadwater, R.P.; Chandrasekaran, A.; Oka, A. *IEEE Transactions on Power Systems (Institute of Electrical and Electronics Engineers) (USA)*, 5(2): 359-366 (May 1990). DOE Contract AC05-84OR21400.

This paper presents an approach for estimating air conditioning load curves based on household duty cycles. The duty cycles are calculated from heat transfer rates using household audit data, thermostat settings, and outdoor temperatures. The fit between the load curves estimated from the duty cycle model and load curves calculated from measured data for households where customers set and forget their air conditioner is presented. The air conditioner and heat pump data used in this paper were gathered during the load control experiments conducted in the summer of 1987 on the Athens Utilities Board distribution system in Athens, Tennessee. Data collected on days when there was no control were used to evaluate the concept of the duty cycle coefficient which was then used to calculate the duty cycle of heat pumps and air conditioners. The theoretical calculations based on the model are then compared to actual measured data.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 43824, 43829, 43838, 43870, 44207, 44379, 44382, 44383, 44384, 44456, 44464, 44467, 44469, 44470, 44472, 44475, 44482, 44588

44447 (CERI-90-01036, pp. 1-14, Paper 6) **The world oil market: Current situation and medium-term outlook: A Middle East perspective.** Jaidah, A.M. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344--: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG-90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This overview of the current and medium-term outlook in the Middle East includes both economic and political factors in its analysis. The paper describes the current situation in both the OPEC and non-OPEC countries; presents the demand and supply aspects for the medium term; and considers the role of Saudi Arabia, and the potential impact of the Iraq/Iran conflict and the Arab/Israeli conflict on Middle East supply. The paper concludes that the Middle Eastern oil producing countries are both the influential and the swing producers of crude oil for the world and potentially have the forces to regulate and stabilize the world petroleum market. However, current circumstances are not favourable for the performance of this role. As a result of these factors, the Middle East is likely to remain unstable, with volatile prices, for many years yet.

44448 (CERI-90-01036, pp. 1-9, Paper 1) **Crude oil supply and demand prospects in Africa.** Adams, G.A. (Nigerian National Petroleum Corp., Lagos (Nigeria)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344--: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG-90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper gives an overview of crude oil reserves and production, demand for petroleum products, exports, and prospects for 1990-2000 in Nigeria. The paper concludes that the development of crude oil potential beyond the currently known limits will rely heavily on the participation of foreign capital as well as foreign technology. If the main African producers are able to maintain their spare production capacity, existing reserves will allow the African countries to sustain a production rate of about 6 million bbl per day (mbd) and a net export level of 4 (mbd) through to 2000. 5 tabs.

44449 (DOE/EIA-0533) **Energy consumption by end-use sector: A comparison of measures by consumption and supply surveys.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 6 Apr 1990. 40p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE90015858. Source: NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

This report was prepared in response to a request from the Office of Policy Integration in the US Department of Energy for an analysis of how Energy Information Administration data from its consumption surveys compares with data from its supply surveys. The consumption surveys provide valuable details about energy use by the consumers, while the supply surveys provide valuable detail on trends in total consumption. The Office of Policy Integration, and other users of EIA data, often need to rely on supply surveys to understand trends and on consumption surveys to understand market forces. This report highlights those areas where the two types of surveys overlap and reinforce each other and those areas where they have differences. This report is a first step in making both sets of EIA data more useful to policy analysts who use EIA data in their work. 9 tabs.

44450 (IAEA-TECDOC-541, pp. 107-128) **France: A national survey.** Livolant, M. (CEA, Paris (France). Direction de la Strategie et des Relations Industrielles). International Atomic Energy Agency, Vienna (Austria). Feb 1990. (CONF-8806487--: Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries, Vienna (Austria), 27 Jun 1988). In *The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna, 27-30 June 1988 and 6-9 December 1988.* Order Number DE90637324. Source: NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS.

The paper is a collection of tables and graphs describing the French overall energy situation such as total energy resources, energy supply, net electricity generation of all available resources from 1950 to 1987, electricity consumption, electricity balance, thermal electric capacity, primary energy consumption and primary energy demand forecasted up to year 2000. This paper also gives the French nuclear units performances and expected capacity in commercial operation on 1st January of each year from 1989 to 2000. Treating, conditioning and disposing of low, medium and high activity wastes are performed by France's own means and on its own territory. (author). Figs and tabs.

44451 Energy in retrospect: Is the past prologue. Weinberg, A.M. (Oak Ridge Associated Universities, Inc., TN (USA)). *Proceedings of the American Power Conference (USA)*, 51: 35-42 (1989). (CONF-890425--: American power conference, Chicago, IL (USA), 24-26 Apr 1989).

This paper presents an overview of U.S. energy policy. The effect of the discovery of fission is focused on and issues regarding the growth in energy demand are addressed.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 43772, 43773, 43775, 43776, 43834, 43871, 43884, 43885, 44121, 44386, 44410, 44427, 44432, 44468, 44481, 44585, 46266

44452 (CERI-90-01031, pp. 1-6, Section 1) **The U.S. National Energy Strategy.** Grundy, T. Jr. (United States Dept. Of Energy, Wassington, D.C. (USA)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910432--: 22. annual Propane Gas Association of Canada Transportation symposium, Calgary (Canada), 25-26 Oct 1989; MICROLOG-90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source:

PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper describes the U.S. Department of Energy's initiatives in the field of energy policy, including the development of the U.S. National Energy Strategy and the launching of a major export initiative in petroleum services and equipment. The effect of the U.S./Canada Free Trade Agreement and its effect in the energy sector is considered, particularly in the export of natural gas from Canada to the U.S. The Clean Air Bill, and its effects upon the energy industry, is also considered.

44453 (CERI–90-01036, pp. 1-11, Paper 14) **Energy development in Malaysia.** Hashim, Y.D.M. (Petroleum Nasimat Berhad, Kuala Lumpur (Malaysia)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper describes the energy policy adopted by the Malaysian government, consisting of a four-fuel policy which addresses mainly the supply side and is aimed at introducing diversification in energy options to the country in the form of natural gas, hydropower, coal, and oil. The paper describes the available reserves of each source, then summarizes the demand for energy by sector. Central to Malaysia's future energy development will be the utilisation of indigenous natural gas resources, especially with regards to transportation and the development of a petrochemical industry.

44454 (CERI–90-01036, pp. 1-17, Paper 12) **[Evolution of the energy security debate in Canada].** Masse, M. (Energy, Mines and Resources Canada, Ottawa, ON (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper discusses the evolution of the energy security debate in Canada, beginning with the report by the National Energy Board in 1986 on Canadian energy supply and demand. This report led to the establishment of a federal/provincial task force and a series of ministerial meetings which established the nature of the problem and the type of policy to be followed. This policy was based upon a cost-effective and balanced mix of emergency and longer term measures. Energy options include the concept of a market-based energy policy, particularly as it relates to interprovincial and international trade; the desire for equitable treatment among energy industries; the integration of environmental considerations and values in energy decision making; security of supply; and balancing the interests of industry, regions, consumers and native people in energy policy planning.

44455 (NEB-SS–BT31-2/1991-III-14) **National Energy Board, 1990-91 estimates: Part 3. Expenditure plan.** National Energy Board, Ottawa, ON (Canada). 1990. 71p. (MICROLOG–90-03685). Source: PC National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $4.00; OTHER COUNTRIES: $4.80 CAN; MF $10 CAN.

The National Energy Board of Canada is responsible for regulating certain energy-related activities within federal jurisdiction, primarily pipelines, international electric power transmission, and energy exports. It also provides advice to the government on energy related issues. This document presents an overview of the Board's program, giving highlights of plans and recent performance, program objectives and effectiveness, and a profile of the program's resources, in the areas of facilities regulation, traffic/tolls/tariffs regulation, export/import regulation, advisory and inquiry activities, and administration. Budgetary information is detailed for specific parts of the Board's activities. 11 figs., 7 tabs.

44456 (NEB-SS–NE1-1989F) **National Energy Board annual report, 1989.** National Energy Board, Ottawa, ON (Canada). 1989. 142p. (MICROLOG–90-04249). Source: PC National Energy Board, Regulatory Support Office, 473 Albert Street, Ottawa, Ont., CAN K1A 0E5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The National Energy Board is a Canadian federal regulatory tribunal whose powers include the licensing of oil, natural gas, and electricity exports, the certification of interprovincial and international power lines, and the setting of tolls and tariffs for oil and gas pipelines under federal jurisdiction. The Board also keeps under review the Canadian supply of all major energy commodities, with emphasis on electricity, oil, natural gas, and the by-products derived from oil and natural gas, as well as the demand for Canadian energy in Canadian and export markets. The Board also has responsibilities under the Northern Pipeline Act and the Energy Administration Act. This report reviews the year's activities of the Board and also presents a review of energy developments in Canada, such as energy production and consumption, exports, and reserves. As part of the Board's activities, hearings are conducted on various matters and the major decisions, and information on applications to the Board, are summarized. The changes made during the year to the acts, regulations, and rules under which the Board operates are also given. 25 figs., 36 tabs.

44457 (OH/GE–02) **Review of the environmental assessment for the flue gas desulphurization (FGD) program.** Ontario Hydro, Toronto, ON (Canada). Nov 1988. 287p. (CE–03092). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This review provides background information on the Environmental Assessment Act, the requirements of the Environmental Assessment Act, and a summary description of the undertaking and the approval that is being sought. It also contains an evaluation of whether the environmental assessment (EA) contains the required components as stipulated. The evaluation examines the proponent's planning process, scope of the environment, method of analysis, public and agency involvement in pre-submission consultation, the range of alternatives, mitigation measures and environmental advantages and disadvantages. An evaluation on the technical quality and completeness of the information contained in the EA, how well the EA addresses reviewers' policy interests, and the conclusions of the Environmental Assessment Branch on how well the EA meets the relevant section of the Act concludes the review. Appendices contain the review questions and the reviewers' comments on the EA.

44458 **A comparison of energy intensity in the United States and Japan.** McDonald, S.C. (Battelle Pacific Northwest Lab., Richland, WA (USA)). pp. 21-30 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). DOE Contract AC06-76RL01830. (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper provides a comparative analysis of energy intensity in the U.S. and Japan. According to aggregate International Energy Agency (IEA) data, the U.S. has one of the most energy-intensive economies while Japan has one of the least. This paper constructs and examines energy-intensity measures that are more detailed than aggregate measures used by the IEA to see if they can better explain these differences. The year chosen for this analysis is 1985.

44459 **It only looks like a camel: The public side of the partnership.** Stewart, F.M. pp. 335-337 of Strategies for reducing

natural gas, electric and oil costs. Association of Energy Engineers, Atlanta, GA (USA) (1990). (CONF-891028–: 12. world energy engineering congress, Atlanta, GA (USA), 24-28 Oct 1989).

The basic concerns and issues of federal procurement regulations are assessed in this paper. In addition to these procurement guidelines, there is a series of socio-economic goals that Congress has set for federal procurement through provisions such as Davis-Bacon and minority set-asides. The core issues of federal procurement are audit trail, biased decision making, competitive fairness, and designated recipient.

2940 Fossil Fuels

Refer also to citation(s) 43716, 43770, 43772, 43773, 43775, 43776, 43784, 43810, 43811, 43812, 43818, 43819, 43820, 43821, 43822, 43823, 43825, 43827, 43830, 43831, 43832, 43834, 43838, 43869, 43870, 43883, 43884, 43886, 43887, 43888, 44382, 44383, 44449, 44527, 44533

44460 (CERI–90-01031, pp. 1-39, Section 6) **Petroleum exploration and development propects in Australia.** Alderson, B. (Petroleum Policy Branch, Australian Dept. of Primary Industries and Energy, Canberra (Australia)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910445–: 8. CERI [Canadian Energy Research Institute] international oil and gas markets conference, Calgary (Canada), 22-24 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

While Australia is lightly explored by world standards, the industry is only 25 years old and has risen to a place of importance in the economy. This paper describes the currently producing areas and the exploration prospects for both onshore and offshore. The administrative arrangements and the federal government's fiscal and policy regimes are also included. A short description of the natural gas network is given. Government information bulletins on legal and administrative arrangements, foreign investment policy, marketing and pricing of crude oil, general taxation arrangements, petroleum taxation and resource rent taxation, offshore petroleum titles, and the proposed Australian/Indonesian zone of cooperation in the Timor Gap are also included. 1 tab., 4 figs.

44461 (CERI–90-01031, pp. 1-9, Section 1) **OPEC [Organization of Petroleum Exporting Countries] oil in the 1990s.** Subroto, H.E. (Organization of Petroleum Exporting Countries, Vienna (Austria)). Canadian Energy Research Inst., Calgary, AB (Canada). [1989]. (CONF-8910432–: 22. annual Propane Gas Association of Canada Transportation symposium, Calgary (Canada), 25-26 Oct 1989; MICROLOG–90-01031). In *The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings.* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper predicts directions in which demand for oil will go in the decade of the 1990s. The average growth rate of the world's market economies is expected to be between 2.5% and 3.0%, with world demand for oil increasing at an annual average growth rate of about 1.7%. OPEC's share is expected to rise and non-OPEC supplies are projected to fall. However, OPEC will strive to maintain stability through quotas and management of the petroleum market.

44462 (CERI–90-01036, pp. 1-14, Paper 22) **[Oil and gas industry in Alberta].** Webber, N. Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper reviews the oil and gas industry in Alberta, focusing on the restoration of interest in the conventional industry, indicated by a large influx of new venture capital and a surge in drilling activity well beyond the forecast levels; the growing interest in bitumen and heavy oil projects; and the outlook for natural gas, which is very good now that substantial progress has been made on deregulation and supplies are tightening in the U.S.

44463 (CERI–90-01036, pp. 1-29, Paper 20) **The effects of the November 1986 deregulation of the Canadian gas industry: The producer's perspective.** Stewart, D.M.G. (Canterra Energy Ltd., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper discusses both the general issues for producers in natural gas deregulation in Canada and more specifically, how deregulation impacted on Canterra Energy Ltd. in its role as a natural gas producer in Alberta. The paper addresses the questions of how the market, and producers' understanding of those markets, changed; how deregulation has affected the day-to-day operations, long-term strategic planning, and sales results; how Canterra now views their competitors; and how the role of government affects the business. 5 figs.

44464 (CERI–90-01036, pp. 1-5, Paper 19) **China: Current situation and outlook.** Smil, V. (Dept. of Geolography, Univ. of Manitoba, Winnipeg, MB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper presents an overview of the Chinese petroleum industry, current crude oil production, petroleum demand, and offshore explorations. The energy demand outlook indicates a potential particularly for more automobiles, as well as for other transportation fuels.

44465 (CERI–90-01036, pp. 1-13, Paper 3) **Canadian market developments.** Cameron, G.W. (Pan-Alberta Gas Ltd., Calgary, AB (Canada)). Canadian Energy Research Inst., Calgary, AB (Canada). [1987]. (CONF-8709344–: 6. annual international oil and gas markets conference, Calgary (Canada), 28-29 Sep 1987; MICROLOG–90-01036). In *[The sixth annual international oil and gas markets conference].* Source: PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN.

This paper describes Pan-Alberta Gas Ltd.; presents a brief history of the development of the Canadian market for natural gas and the regulatory evaluation that has taken place in Canada with special emphasis on the October 1985 Agreement between the Governments of Canada, Alberta, B.C. and Saskatchewan; and discusses how the U.S. deregulation process has affected the Canadian natural gas market. The paper concludes with an evaluation of what the future has to offer, including more change, increased competition, pipeline expansions to the northeast and midwest U.S., a diminishing of the gas bubble, continued government control in some form, and a price ceiling on natural gas set by crude oil.

44466 (COGLA–90-03338) **Environmental Studies Research Funds annual report, 1989.** Canada Oil and Gas Lands

Administration, Ottawa, ON (Canada). [1990]. 15p. (MICROLOG–90-03338). Source: PC Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, Ont., CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Initiated in 1983, the Environmental Studies Research Funds (ESRF) is a program of funding for environmental and social studies related to oil and gas development on Canadian frontier lands. A focused program, it deals exclusively with research to assist in decision-making related to oil and gas exploration and development. Funding for the ESRF is provided through levies on the oil and gas companies that hold interests on frontier lands. Administration is provided by the Environmental Protection Branch of the Canada Oil and Gas Lands Administration. Management of the ESRF was restructured in 1988 to include representation from the federal government, the oil and gas industry, the regional petroleum boards and the general public. The bulk of the technical work of the ESRF is performed by a series of Program Study Committees who provide expert advice in priority subject areas identified by the Board. These committees are comprised of scientific and technical experts from the oil and gas industry and the federal, provincial and territorial governments. This report summarizes the year's activities of the ESRF and includes descriptions of current research projects and a list of publications. In 1989, a research program valued at $538,000 was carried out. Six projects are described, focusing on the Grand Banks and the Beaufort Sea. These projects investigated the tainting of commercial fish species by spilled oil, sensitivity of fish larvae to petroleum hydrocarbons, environmental effects monitoring strategies, extreme waves, iceberg scours, and documentation and archiving of marine radar data sets. A list of ESRF reports is included.

44467 The role of oil in electricity generation in five European countries: Past, present, and potential. Hawk, D.V. (Lawrence Berkeley Lab., CA (USA)); Schipper, L. pp. 99-110 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper explores how the role of oil in electricity generation has changed over the last 15 years, and contemplates the potential role(s) of oil in generation in both the immediate future and over the long-term planning horizon. Past oil crises in Europe are examined, and present oil capacities in these countries are offered.

44468 The new sisters: Downstream intergration and U.S. national energy policy. Coburn, L.L. pp. 53-64 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper discusses the downstream integration or reintegration movement by national oil companies into the downstream segments of refining and marketing of the oil industry. Kuwait, Venezuela, and Saudi Arabia are the most prominent countries to make these investments. Due to their size they may be considered the new sisters of the international oil industry. According to this analysis, the implications of the movement downstream are important for the world oil industry and for U.S. policymakers.

44469 Use of the world model to analyze strategic reserves drawdown. Breton, T.R. (ICF, Inc., Fairfax, VA (USA)). pp. 261-266 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper provides a summary of some of the market analysis performed on crude oils. The author presents the model used for simulations performed to examine the effect on the petroleum market of changing the mix of crude oils made available during certain disruptions of crude oil supplies.

44470 Strategic petroleum reserve expansion. Leiby, P.N. (Oak Ridge National Lab., TN (USA)); Lee, R. pp. 249-260 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper describe the strategic petroleum reserve (SPR) benefits and proposes a general paradigm for SPR decision-making. It presents two modeling approaches to the general decision problem, each simplifying the problem in a different way and offering a distinct perspective. The first is the Teisberg model approach, applying dynamic programming, and some recent numerical results on the value of SPR capacity expansion are presented. The shortcomings of the Teisberg approach are then highlighted, motivating the application of an alternative modeling method. The second modeling method, called the Hogan-Leiby Risk Analysis model is used to obtain some comparative results on SPR expansion benefits.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 44493

2960 Electric Power

Refer also to citation(s) 44092, 44101, 44122, 44123, 44207, 44446, 44449, 44494, 44502, 44505, 44512, 44573, 44574, 45029, 45039

44471 (DOE/EIA–0226(90/05)) **Electric power monthly, May 1990.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 10 Aug 1990. 182p. Sponsored by U.S. DOE Management & Administration. Order Number DE90016114. Source: NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, and average revenue per kilowatthour of electricity sold. Data on net generation are also displayed at the North American Electric Reliability Council (NERC) region level. Additionally, company and plant level information are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fuel. 4 figs., 40 tabs.

44472 (DOE/IE–0018) **Staff report: Electric power supply and demand for the contiguous United States, 1989–1998.** US-DOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC (USA). Office of the Deputy Assistant Secretary for Energy Emergencies. Mar 1990. 192p. Sponsored by U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. Order Number DE90016004. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report reviews the bulk electric power supply and demand situation for the contiguous United States as projected for 1989–1998 in the April 1, 1989, IE-411 reports of the nine Regional Electric Reliability Councils. These annual reports are regarded as embodying the consensus of US electric utilities concerning the US electric power supply and demand for the next decade. The consensus should be viewed in the context of the uncertainty associated with projection of future events. The conclusions of this report are based on analysis of the data as reported. Actual conditions may in general correspond to the forecasts, although exact correspondence year-by-year is unlikely even in the absence of unforeseeable catastrophes such as earthquakes and extreme droughts. The evaluation of supply adequacy, in this report, is based on the use of "adjusted reserve margin" as a criterion. Adjusted reserve is computed by using averages of historical data for capacity unavailability to reduce installed reserve to an amount more likely to be realistic. Calculations based on average data may or may not be borne out exactly be events, but they do provide a relatively simple method of judging the adequacy of projected power supply.

44473 (EMR/V/CRE–CE02911, pp. 27-42) **Private power development.** Passmore, J. (Passmore Associates International, Ottawa, ON (Canada)). Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office. [1987]. (CONF-8703337–: Small hydro Canada '87, Burnaby (Canada), 24-27 Mar 1987; CE–02911). In *Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars.* Source: Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST.

This paper discusses private sector generation of electricity through small hydro projects and the effect of proposed deregulation on future electrical generation. The major problems which face a private power developer are obtaining project financing, getting contracts to sell his power, and price. There is no problem with utility monopoly over distribution. The advantages of deregulation are summarized. Private power producers should be able to sell their entire output to a utility at full avoided cost, while purchasing their needs at utility retail rates. Private power producers should be paid for capacity in the short term, whether or not the system needs additional generation at the time, and they should be allowed to wheel power from one jurisdiction which does not want the power to another jurisdiction that does. It is important that buy-back rates reflect marginal cost and that marginal-cost determinations be conducted in a public forum. Established utilities do not want many private power producers, and they do not want to deal with them as an organized profession. Pressure on the Canadian government is advocated to enforce a policy of marginal-cost pricing for privately generated power.

44474 (EPRI-CU–6789) **Textile industry: Profile and DSM [demand-side management] options: Final report.** Electric Power Research Inst., Palo Alto, CA (USA); Resource Dynamics Corp., Vienna, VA (USA); Battelle, Columbus, OH (USA). ©Jul 1990. 219p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Textile Industry Guidebook provides electric utility planning, marketing, and customer service staff with a practical tool to better understand the textile industry and the challenges it faces; its manufacturing processes, technologies, and energy use; and its opportunities for demand-site management (DSM). The Guidebook concludes with guidance and summary data for developing and evaluating DSM plans to realize such opportunities. 5 refs., 37 figs., 52 tabs.

44475 (ETDE-IT–90-41) **Electric power demand to the year 2000: Utility investment planning techniques.** Leon, P.; Tenenbaum, M.; Manfra, L.; Scarpetta, S.; Gizzi, A.; Chapman, S. ENEA, Rome (Italy). Apr 1988. 153p. (In Italian). Order Number DE90514427. Source: NTIS (US Sales Only), PC A08.

This paper deals with an economic evaluation of investments in the field of electric power. A review is made of economic and financial evaluation methodologies and techniques (i.e., cost benefit analysis, load management, cash flow and rate structure optimization, power plant energy audits, etc.) applicable to energy policy planning by ENEL (Italian Electricity Board). Emphasis is placed upon an assessment of supply and demand forecasting techniques. Comparisons are drawn with methods employed by Electricite' de France.

44476 (HQ–90-03608) **Hydro-Quebec annual report, 1989.** Hydro-Quebec, Montreal, PQ (Canada). [1990]. 80p. (MICROLOG–90-03608). Source: PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This annual report for the Quebec electric utility presents an overview of the year's activities and its financial status, including export sales of electricity to New Brunswick, Ontario, New York State, and the New England states. Research programs and demonstration projects are described, as well as the utility's activities in Africa and Asia. Environmental and economic considerations for the province are presented. Financial data includes total sales, sales by sector, export sales, and rate changes. A financial statement is included. In 1989, the sixth year of below-average runoffs causing water shortages in the hydroelectric reservoirs, export sales fell dramatically; short-term, non-firm energy contracts were very limited. Measures taken to alleviate the problem include making more use of the Tracy thermal generating station, buying power from other utilities, and encouraging dual-energy customers to use their other energy source. On the other hand, Hydro-Quebec's largest ever export contract was signed with the New York Power Authority for delivery of 1,000 MW and 131 billion kWh from 1995 to 2016. Two seasonal-demand delivery contracts were also signed. 11 figs., 2 tabs.

44477 (PB–90-235664/XAB) **List of materials: Acceptable for use on systems of REA electrification borrowers.** Rural Electrification Administration, Washington, DC (USA). Jul 1988. 357p. (REA-BULL–43-5). Source: NTIS, PC A16/MF A02.

Also available from Supt. of Docs.

The items shown in the publication include material and equipment for transmission and distribution facilities and specific items of electric general plant. Items not listed include office equipment, tools and work equipment, and consumer owned wiring facilities. The listings apply only to new items of material and equipment and not to used items. In addition to items accepted on a general basis, this list also includes items accepted on a conditional basis. As one of the conditions in the listing of an item on a conditional basis, contractors are required to obtain the borrower's concurrence prior to its use.

44478 (PB–90-874041/XAB) **Electric power load management. January 1982-June 1990 (A Bibliography from the NTIS data base). Report for January 1982-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 71p. Source: NTISPC N01/MF N01.

Supersedes PB–89-851851.

This bibliography contains citations concerning residential, commercial, and industrial load management. Load forecasting, the impact of alternative energy strategies, dispersed generation, off-peak power usage, cogeneration, and communication systems used in distributed control are among the topics presented. Capacity expansion analysis, the use of computer models in forecasting and system planning, and consumer attitudes regarding load control and rate structures are also discussed. (This updated bibliography contains 121 citations, 27 of which are new entries to the previous edition.)

44479 (PNL–7419) **The End-Use Load and Consumer Assessment Program: Characterization of commercial load shapes by weather day type.** Hadley, D.L. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 33p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract AC06-76RL01830. Order Number DE90015557. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recently, an objective methodology to characterize air masses for a given locale was developed by Kalkstein and Corrigan (1986). This methodology was used to determine which air masses had the greatest potential for high atmospheric concentrations of sulfur dioxide. Referred to as the temporal synoptic index (TSI), this approach uses a combination of principal component analysis (PCA) and cluster analysis to identify days considered to be meteorologically homogenous. The PCA transforms the original set of intercorrelated meteorological variables into a new set of components that are linear combinations of the original variables. This transformation simplifies the amount of data being processed and eliminates the intercorrelations that exist among weather variables. The next step in the methodology is to apply an objective clustering scheme to the most significant of the transformed variables. This application converts the group's days into meteorologically homogeneous clusters. The work presented in this report is the result of an exploratory study of the application of the TSI approach to the analysis of commercial building energy consumption data. In this study, the hourly HVAC consumption data for four commercial buildings, monitored as part of ELCAP, were analyzed for patterns of consumption by weather day types derived from the TSI methodology. 3 refs., 9 figs., 5 tabs.

44480 (UCRL-JC-103606) **The need for a full-system analysis when evaluating energy options.** Oversby, V.M. Lawrence Livermore National Lab., CA (USA). Jul 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9008109-1: International conference on environmental issues and management of waste in energy and minerals production, Secaucus, NJ (USA), 27-29 Aug 1990). Order Number DE90015146. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The United States Department of Energy (DOE) is preparing a national strategy for energy production. As part of the process, the DOE should evaluate the total risks – both to human health and the environment – resulting from different methods of energy generation. The costs of each method of energy production should than be evaluated and compared to the risks associated with production. This analysis could then provide the means to make judgments concerning relative risks and costs for risk avoidance. These data are needed both to make decisions between energy options and also to assess the cost of risk avoidance in energy generation as compared with costs of risk avoidance in other matters of national concern. Assessment of the risks of environmental damage to due to mining and those due to non-radioactive emissions during power production have only recently received wide attention. These effects are more difficult to quantify, and in many cases are dependent on complex models of the global climate, which contain many uncertainties due to our imperfect understanding of some the key physical and chemical phenomena that control the global climate. This paper discusses the topics that need to be understood in order to make a relative risk assessment for two methods of energy generation: nuclear and coal-fired power production. 13 refs., 4 tabs.

44481 **The role of transmission access in recent FERC initiatives in the electricity industry.** Stalon, C.G. (USDOE Federal Energy Regulatory Commission, Washington, DC (USA)). *Proceedings of the American Power Conference (USA),* 51: 352-356 (1989). (CONF-890425--: American power conference, Chicago, IL (USA), 24-26 Apr 1989).

The author discusses three notices of proposed rule-makings (NOPRs) issued by the Federal Energy Regulatory Commission. These NOPRs pertain to the rules for defining prices that franchised utilities must pay when purchasing energy and capacity from qualifying facilities and to the issue of market structure in the electricity industry.

2980 Consumption and Utilization

Refer also to citation(s) 44475, 44512, 44513, 44533

44482 (ETDE-IT-90-54) **Energy and economy: Statistical data base.** ENEA, Rome (Italy). Jun 1989. 193p. (In Italian). Order Number DE90514430. Source: NTIS (US Sales Only), PC A09/MF A01.

This compilation of energy and economics data was carried out by ENEA (Italian Commission for Alternative Energy Sources). The world, national and regional statistical data report information on population growth, employement, gross national product (including per capita values), consumer prices, trade balance, government lending and borrowing, production/consumption of fossil fuels (sectoral analysis), uranium and nuclear energy.

44483 (PB-90-232471/XAB) **Minerals yearbook, 1988: Industrial sand and gravel.** Bolen, W.P. Bureau of Mines, Washington, DC (USA). 1988. 16p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

Production of industrial sand and gravel in 1988 increased to 28.5 million short tons, about a 2% increase over that of 1987, but remained 15% below the record-high production level of 1979. The production increase was due in part to the addition of new operations in California and Tennessee. Imports of industrial sand and gravel decreased about 59% in quantity, but the associated value increased 79%. Exports of industrial sand and gravel increased about 40% in quantity with a slight increase in average value per ton. Domestic apparent consumption of industrial sand and gravel in 1988 was 27.5 million tons.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 43776, 44206, 44423, 44571

44484 (ETDE-IT-90-57) **ENEA programm in the field of renewable energy sources.** Bianchi, G.; Ambrosini, G. ENEA, Rome (Italy). Sep 1989. 5p. (CONF-890923-3: World congress of the International Solar Energy Society, Kobe (Japan), 4-8 Sep 1989). Order Number DE90514431. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the ISES solar world congress 1989 (Kobe, 4-8 Sep 1989).

In consideration of Italy's strong dependence on imported energy and in view of the targets established by the Italian National Energy Plan, renewable sources, especially solar, are expected to play a strategic role in Italy, due to Italy's favourable geographical position. The Italian Energy Plan has allocated a central task to ENEA (Italian Commission for Alternative Energy Sources), that has to take care of research and development activities, pursue demonstration programs, promote Italian industry for the development of technologies in the energy sector and finally to qualify the Italian industry. ENEA has also the task to provide advice and support to the Public Administration in initiatives in the field of new types of energy and energy saving.

44485 (PEEF-90-04172) **Prince Edward Island Energy Corporation annual report, 1988-1989.** Department of Energy and Forestry, Charlottetown, PE (Canada). 1989. 26p. (MICROLOG-90-04172). Source: PC Prince Edward Island. Dept. of Energy and Forestry, Shaw Bldg., 105 Rochford St., PO Box 2000, Charlottetown, PE, CAN C1A 7N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The objectives of the Energy Corporation are to develop and promote energy systems on an economic and efficient basis and to coordinate all government programs in the establishment and application of energy systems in the province. The Corporation operates within the general framework of provincial energy policy which is the responsibility of the Minister of Energy and Forestry. A summary is provided of the Corporation's activities during the year and includes a summary of demonstration programs, research projects, and successful energy system applications. Highlights include startup of the second phase of a district heating system at a university, the sixth successful year of operation of an energy-from-waste plant, a pilot district heating system in Charlottetown, the heating of provincially owned buildings with wood chip fuel, and various programs to promote the use of wood fuels. Financial statements are also included. 5 figs., 2 tabs.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 44523

44486 (DOE/ET/10815-136) **Priority pollutants in solid phase combustion products from the Department of Energy's MHD [magnetohydrodynamics] Coal-Fired Flow Facility: Final report.** Parks, K.D. Tennessee Univ., Tullahoma, TN (USA). Space Inst. May 1990. 37p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-79ET10815. (UTSI-89-06). Order Number DE90015859. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One area not addressed in the past assessments of a coal-fired, open-cycle Magnetohydrodynamics (MHD) system is the presence, location, and behavior of EPA-listed priority pollutants. Consequently, an effort was started to identify and quantify the minute constituents leaving an MHD system. At the University of Tennessee Space Institute (UTSI), representative samples were obtained from the major components of the Department of Energy's MHD Coal-Fired Flow Facility (CFFF) from three tests (LMF4-H, LMF4-1, and LMF4-K), and analyzed for selected trace constituents. In this program, priority pollutant analyses were implemented to: determine the composition of Eastern & Western coal

solid combustion products collected from various locations along a prototypical MHD flow train during the firing of Illinois No. 6 and Montana Rosebud coals; and compare solid combustion products generated from MHD and conventional power plant technologies. This topical report provides the major results, to date, from this program, and outlines our future plans. 15 refs., 7 figs., 15 tabs.

44487 (DOE/ET/15601–38) **Diagnostic development and support of MHD test facilities: Technical progress report, July, August, September 1989.** Mississippi State Univ., Mississippi State, MS (USA). Diagnostic Instrumentation and Analysis Lab. Oct 1989. 67p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-80ET15601. Order Number DE90015403. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Diagnostic Instrumental and Analysis Laboratory (DIAL) at Mississippi State University (MSU) is developing diagnostic instruments for MHD power train data acquisition and for support of MHD component development test facilities. Microprocessor-controlled optical instruments, initially developed for HRSR support, are being refined, and new systems to measure temperatures and gas-seed-slag stream characteristics are being developed. To further data acquisition and analysis capabilities, the diagnostic systems are being interfaced with DIAL's computers. Technical support for the diagnostic needs of the national MHD research effort is being provided. DIAL personnel will also cooperate with government agencies and private industries to improve the transformation of research and development results into processes, products and services applicable to their needs. Some tests were conducted at the Coal-Fired Flow Facility (CFFF) at UTSI, and the Component Development and Integration Facility (CDIF), Butte, Montana.

3005 Fuel Cells

Refer also to citation(s) 45744

44488 (LA-UR–90-2538) **The physical and chemical state of Westinghouse Phosphoric Acid Fuel Cell assemblies after long term operation: Surface and near-surface analysis.** Paffett, M.T. (Los Alamos National Lab., NM (USA)); Hutchinson, W.; Farr, J.D.; Papin, P.; Beery, J.G.; Gottesfeld, S.; Feret, J. Los Alamos National Lab., NM (USA). [1990]. 37p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-36. (CONF-901073–6: 178. meeting of Electrochemical Society, Inc., Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90015055. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An attempt was made to correlate performance losses with materials compatibility and compositional changes in Phosphoric Acid Fuel Cell (PAFC) electrode assemblies as a function of operation time. Westinghouse PAFC stacks were run under a constant operating regime and portions of some of the single cells were analysed after stack operation for 5000 hrs and for 16,000 hrs along with appropriate reference samples. The PAFC assemblies were disassembled, sectioned where appropriate and analyzed using scanning and transmission electron microscopy (SEM and TEM), Rutherford backscattering spectroscopy (RBS), electron microprobe analysis (EMP), and x-ray photoelectron spectroscopy (XPS). The profiles of the Pt catalyst in both the anode and the cathode layer did not show any preferential loss or peaking. The most pronounced change in cell composition detected following stack operation for 5000 and for 16,000 hours was the increase in Pt/C ratio, that was related to loss of carbon from the cathode electrocatalyst. In contrast, the anode catalyst layer maintains the same ratio of Pt/C following 16,000 hours of operation. The loss of carbon is thought to occur by an electrochemical mechanism and is enhanced at the higher potentials experienced by the air cathode in the fuel cell. In addition, TEM results clearly demonstrate the well recognized phenomenon of Pt particle agglomeration in the cathode catalyst layer, which is seen to be quite substantial after 5000 hours of stack operation. The mechanical integrity of the assemblies was found to be quite satisfactory after 5000 hours, but much less so after 16,000 hours. Questions regarding carbon and Pt corrosion, Pt migration, and the mechanical and physical integrity of the PAFC structures are addressed and are all postulated to be contributing to the observed cell performance losses. 10 refs., 17 figs.

44489 (LBL–27025-Rev.) **Electrochemical evaluation of new fluorosulfonic and fluorophosphonic acids as fuel cell electrolytes: Final report, May 1986–December 1989: Revision.** Saffarian, M.H.; Ross, P.N. Lawrence Berkeley Lab., CA (USA). Dec 1989. 68p. Sponsored by Gas Research Institute. DOE Contract AC03-76SF00098. Contract 5086-260-1229. (GRI–90/0120). Order Number DE90016626. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of this project was to evaluate a series of new fluorosulfonic and fluorophosphonic acid as alternative fuel cell electrolytes having superior performance than phosphoric acid. The procedure for the evaluation of new acids was a two stage process, the first stage being physicochemical property measurements (equivalent weight, state of hydration, conductivity of aqueous solutions) and preliminary electrochemical property measurement using cyclic voltammetry. If the results in the first stage appeared promising, further electrochemical evaluation was begun using either the purified acid by itself in pH = 1 solutions (if a sufficient quantity of acid were available) or the purified acid added to pre-purified 85% phosphoric acid, and measurement of oxygen reduction kinetics either in a rotating disk electrode (RDE) cell or in a small (1 ml) fuel cell.

44490 (PB–90-226341/XAB) **Methane conversion by solid-electrolyte membranes. Annual report, January 1, 1989-December 31, 1989.** Sammells, A.F.; Cook, R.L.; Worrel, W.L. Eltron Research, Inc., Aurora, IL (USA). Apr 1990. 34p. Source: NTIS, PC A03/MF A01.

The work has resulted in the identification of a new strategy for predicting perovskite solid electrolytes with the potential for achieving high ionic conductivities at intermediate temperatures. This approach is based in part upon identification of a clear relationship between the activation energy for ionic conduction in perovskite solid electrolytes and the free volume of their lattice structures, where free volume is defined as the difference between the volume of the perovskite crystallographic unit cell and the volumes occupied by the constituent ions resident at lattice sites. Other restrictions incorporated towards selection of perovskite solid electrolytes included: avoiding ionic radii mismatch between dopants and the ionic species they replace, and ensuring that the aliovalent dopant concentration within the perovskite lattice is below a level where introduced lattice vacancies become ordered, resulting in a decrease in ionic conductivity. This has resulted in the fabrication and preliminary testing of fuel cells operating at intermediate temperatures.

44491 (PNL-SA–17012) **Advanced materials and electrochemical processes in high-temperature solid electrolytes.** Bates, J.L.; Chick, L.A.; Weber, W.J.; Rieke, P.C. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC06-76RL01830. Order Number DE90015290. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this research and development effort is to (1) identify, develop, and demonstrate advanced materials for use as alternative electrodes and current interconnections in solid oxide fuel cell (SOFC), and (2) develop and understanding of the synergistic effects of materials properties, structures and compositions on electrochemical processes related to high-temperature solid electrolyte use in electrochemical cells. Electric conductivity of the following materials was investigated: ZrO_2–TiO_2–Y_2O_3; ZrO_2–Y_2O_3; and interconnection materials of La(Sr)CrO_3; and La(Mg)CrO_3. 6 refs., 6 figs., 2 tabs.

44492 (PNL-SA–17577) **Advanced materials and electrochemical processes in high-temperature solid electrolytes.** Bates, J.L.; Chick, L.A.; Youngblood, G.E.; Weber, W.J. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 30p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC06-76RL01830. Order Number DE90015552. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this research and development effort is to (1) identify, develop, and demonstrate advanced materials for use as alternative electrodes, current interconnections and electrolytes in high-temperature solid-electrolyte electrochemical cells, and (2) develop an understanding of the synergistic effects if materials

properties, structures and compositions on electrochemical processes in high-temperature solid electrolyte electrochemical cells. Materials evaluated (anodes) include oxides of Y, Zr, and Ce; materials evaluated as interconnects include $La_xSr_xCrO_3$ and $La_xSr_xAl_xO_3$. 11 refs., 16 figs., 2 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 44379

44493 (PB–90-232414/XAB) **Minerals yearbook, 1988: Helium.** Leachman, W.D. Bureau of Mines, Washington, DC (USA). 1988. 12p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

Grade-A helium (99.995% or better) sales volume in the United States by private industry and the Bureau of Mines was 1,911 million cubic feet (MMcf) in 1988. Grade-A helium exports by private producers were 663 MMcf, for total sales of 2,574 MMcf of U.S. helium. The price of Grade-A helium, f.o.b. plant, was about $37.50 per thousand cubic feet (Mcf) for both the Bureau and private industry. The Bureau price for bulk liquid helium was $45.00 per Mcf with additional costs for container services and rent. The liquid helium price of private industry was also about $45.00 per Mcf with some producers posting surcharges to this price. Topics discussed in the report include domestic data coverage, legislation and government programs, domestic production, consumption and uses, stocks, resources, transportation, prices, foreign trade, world review, and technology.

3201 Buildings

Refer also to citation(s) 44145, 44146, 44426, 44446, 44601, 44789

44494 Energy efficiency in buildings: Progress and promise. Energy conservation and energy policy. O'Hara, F.M. Jr. (ed.); Hirst, E.; Clinton, J.; Geller, H.; Kroner, W. 331p. American Council for an Energy-Efficient Economy, Washington, DC (1986). Sponsored by American Council for an Energy-Efficient Economy.

The purpose of this book is twofold: to review current knowledge on energy use and efficiency in residential and commercial buildings and to suggest important research and program topics for future study. The introductory chapters set the stage for subsequent discussions of what we now know and where we want to go. We first review overall patterns of energy use in residential and commercial buildings and the dramatic changes in energy trends after 1973, including the roles of government, utility, and private sector efforts in making these changes. We next discuss reasons for continuing research and programs to improve energy efficiency in buildings and note the complexity and diversity among buildings in their design, construction, operation, maintenance, and use. We then turn our attention to how much has been accomplished and learned about reducing energy use in buildings since the 1973 oil embargo. Finally, we offer many suggestions that merit attention in both the short and long terms. The short-term proposals flow logically from current research and programs on energy efficient buildings. The long-term agenda (including several visions of the future) covers ideas that, in some ways, require changes in how we view our built environment and the social institutions under which buildings are constructed and operated. 406 refs., 52 figs., 33 tabs.

44495 (AFME–86.91.0004) **Feasability study for an aeraulic heating system.** Marchal, D. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre Technique des Industries Aerauliques et Thermiques (CETIAT), 75 - Paris (France). Jan 1987. 37p. (In French). Order Number DE90514543. Source: NTIS (US Sales Only), PC A03/MF A01.

A pulsed hot air (35 degres C) space heating system is proposed and evaluated; the hot air is produced through a heat exchanger with the hot water coming from the heat exchanger of the domestic hot water system. The water is then returned to a re-heating boiler, driven by gas combustion. Designs of the reheating system, the water-air exchanger and the water - domestic water exchanger are presented together with the command and control principles.

44496 (AFME–86.91.0004-1) **Modelization of thermodynamic cycles.** Cecchini, C. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France); Centre Technique des Industries Aerauliques et Thermiques (CETIAT), 75 - Paris (France). Jan 1987. 66p. (In French). Order Number DE90514539. Source: NTIS (US Sales Only), PC A04/MF A01.

A model of the internal operation of a compression thermodynamical engine is developed in order to be able to characterize heat engines, heat-pumps with a minimal number of parameters. The model is then applied to liquid-liquid engines and to air-liquid engines; model results are compared with experimental data.

44497 (AFME-FR–2) **Thermal comfort in Summer from evaluation to design: Proceedings.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1987. 212p. (In French). (CONF-8705407–: Colloquium on thermal comfort in summer, Aix-en-Provence (France), 5 May 1987). Order Number DE90514544. Source: NTIS (US Sales Only), PC A10/MF A01.

The thermal comfort in summer, in households and commercial buildings, has been approached through meteorological and physico-psychological analysis: data concerning temperature, humidity and air speed, radiative temperature, are analyzed to point out the thermal behaviour of buildings in summer and the people behaviour and thermal sensation are correlated the measured data. Design recommendations are proposed (materials, architecture, devices, solar equipment...).

44498 (AFME-FR–6) **Thermal diagnosis manual 1987.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1986. 230p. (In French). Order Number DE90514545. Source: NTIS (US Sales Only), PC A11/MF A01.

The thermal diagnosis manual concerns existing building (residential or commercial); the main objectives of this guide are: information about insulation of the envelope, ventilation and infiltration, heating systems and domestic water heaters; data and characteristics can be easily used with microcomputers or advanced calculettes; the guide presents also evaluation and maintenance procedures.

44499 (BFR-G–2-1989, pp. 657-662) **Technical and economic feasibility of wind convectors as heat pump evaporators.** Monaghan, P.F. (Univ. College, Galway (IE). Mechanical Engineering Dept.); Finn, D.P. Swedish Council for Building Research, Stockholm (Sweden). 1989. (CONF-8808238–: North Sun '88: international conference on solar energy at high latitudes and exhibition, Borlaenge (Sweden), 29-31 Aug 1988). In *North sun '88 proceedings*. Order Number DE90770786. Source: Swedish Council for Building Research, Stockholm, Sweden.

In general, it may be said that wind convector technology can be more reliable and more energy efficient because it allows streamlining of heat pump design by elimination of components and reduction of moving parts. These advantages apply to all heat pumps whether they be driven by electricity, engines or heat. Wind convectors are estimated to provide energy savings of the order of 10 %, maintenance savings of the order of 50 % and a reduction of heat pump capital costs of the order of 11-12 %. Wind evaporators are estimated to provide energy savings of the order of 20 %, maintenance savings of the order of 50 % and reduction of heat pump capital costs of the order of 12-15 %. In addition to these energy, maintenance and capital cost advantages, a further advantage is that wind convector technology provides silent evaporator operation. (12 refs.).

44500 (BNL–44794) **Oil heat research at Brookhaven National Laboratory.** Butcher, T.; Andrews, J.; Celebi, Y.; Coughlan, R.; Krajewski, R.; McDonald, R. Brookhaven National Lab., Upton, NY (USA). Mar 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9003187–1: Residential heating in the 1990's, Halifax (Canada), 26-27 Mar 1990). Order Number DE90015091. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Brookhaven National Laboratory (BNL) has had an active program in residential space heating for the past fifteen years. During this time there has been a dramatic increase in the awareness of the energy efficiency of heating systems and also an improved understanding of the factors which lead to energy losses in these

systems. As a result we have seen an equally dramatic increase in the performance of available systems. BNL's role during this time has been to support the industry through development of efficiency measurement methods, equipment testing, identification of high efficiency alternatives and direct support of advanced technology. In the current BNL program emphasis is on reducing emissions and fouling, bringing in-field performance closer to laboratory performance, improving reliability, and of course advanced equipment for higher efficiency. The purpose of this paper is to provide an overview of current BNL projects which include: Combustion; Performance Controls; Advanced Venting Studies; Fuel Quality; and Systems Integration Technology Transfer. 5 refs., 5 figs., 1 tab.

44501 (CMHC–90-03779) **CMHC [Canada Mortgage and Housing Corp.]/EMR [Energy, Mines and Resources Canada] northern initiatives: interim report # 3 and final report.** Sinha, R.P.; Duncan, R.L. Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 30 Mar 1989. 17p. (MICROLOG–90-03779). Source: PC Canada Mortgage and Housing Corporation, Annex Bldg., 682 Montreal Rd., Ottawa, ON, CAN K1A 0P7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In 1987, a joint venture was established for the purpose of providing technical housing support to the Northwest Territories Housing Corporation. The joint venture terminates on March 31, 1989. This report represents the final report summarizing the activities completed to March 31, 1989 as a result of this joint venture . Many of the field demonstration projects are underway and will continue to be supported to completion. Activities and projects of the joint venture have beeen initiated to respond to technical housing needs in the north. These include the identification and field demonstration of alternative oil fired heating systems more appropriate for northern climate, the field demonstration of ventilation systems for the northern climate including passive ventilation systems, the monitoring of wood moisture content in northern building envelopes, demonstration of integrated heating and ventilation systems, and development of fundamental algorithms for analysis of data being collected as part of the R2000 monitoring program.

44502 (CONF-900833–6) **Evaluating the impacts of model conservation standards on single-family construction practices in the Northwest.** Brandis, P. (USDOE Bonneville Power Administration, Portland, OR (USA)); Cody, B.; Brown, M.A.; Haeri, M.H. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract AC05-84OR21400. From ACEEE summer study on energy efficiency in buildings; Pacific Grove, CA (USA); 26 Aug - 1 sep 1990. Order Number DE90015158. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Bonneville Power Administration (Bonneville) in conjunction with the Northwest Power Planning Council has implemented a wide range of activities to improve building practice in the Pacific Northwest. This range includes offering technical assistance, the use of financial incentives, the Super Good Cents marketing program, the Early Adopter Code Program, and even a threatened surcharge. The purpose of this study is to assess the impacts of these activities on single-family home construction. This is accomplished by comparing the energy efficiency of 1983 pre-program homes with 1987 homes, and by comparing 1987 homes built under Bonneville programs with other homes constructed in the same year. The evaluation is comprised of four interrelated components: an occupant survey, billing history analysis, energy simulation modeling, and construction characteristics data from site visits, including blower door tests. This paper describes the research plan, discusses several methodological issues, and presents preliminary results of this evaluation. 7 refs., 7 tabs.

44503 (CONF-901017–3) **A cost-effective realization of environmental temperature control.** McKnight, T.E.; Mossman, C.A. Oak Ridge National Lab., TN (USA). [1990]. 18p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. From International conference and exhibition of the Instrument Society of America; New Orleans, LA (USA); 14-19 Oct 1990. Order Number DE90011651. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thermal expansion caused by small temperature variations during machining is a limiting factor in the production of high-quality optics. Conventional facilities required for environmental control of machining areas are very expensive and represent significant capital investments for small or medium size companies. This paper describes an economical modularized facility and thermal control system that will maintain temperature stability to within ±0.1°F. This system uses only commercially available instrumentation and heating, ventilating, and air conditioning (HVAC) equipment and provides improved control at much less cost than conventional facilities. 10 figs.

44504 (CONF-9010116–2) **The technical viability of alternative blowing agents in polyisocyanurate roof insulation: Part 4, in-situ thermal aging and performance in different roof systems: [Progress report].** Christian, J.E. (Oak Ridge National Lab., TN (USA)); Courville, G.E.; Linkous, R.L.; Wendt, R.L.; Graves, R.S.; Smith, T.L. Oak Ridge National Lab., TN (USA). [1990]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy; Environmental Protection Agency. DOE Contract AC05-84OR21400. From Polyurethanes '90 conference; Orlando, FL (USA); 1-4 Oct 1990. Order Number DE90015157. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents a progress report on field thermal performance measurements on a set of private industry-produced, experimental polyisocyanurate laminate board stock foams blown with CFC-11, HCFC-123, HCFC-141b, 50/50, and 65/35 blends of HCFC-123/HCFC-141b. These boards have been observed for almost 300 days of roof field exposure in East Tennessee. The field data are used to derive an empirical model which can be used to predict effective diffusion coefficients for the air components into the foam cells. These diffusion coefficients are compared with those developed from steady state laboratory measurements of thin sliced samples from the same batch of experimental boards. The relative performance of test specimens of HCFC-141b under a black and under a white membrane are reported. The aging of the HCFC-141b blown foam under the white membrane occurred more slowly during cold weather, but accelerated after the winter season, resulting in no significant resistivity difference after 280 days of exposure from September 1989 until May 1990. The field data analysis suggests that the percent increase in k over that of the foam blown with CFC-11 is, after one year of aging, 5.5% for HCFC-123 and 11.7% for HCFC-141b. This leads to the same ordering as derived from the laboratory thin-slicing analysis report in Part 3 of this session. Additional plans are described for further thermal and mechanical property measurements to be conducted on two ORNL roof field testers. After the first year of this three-year study, there has been no indication that thermal performance differences are serious enough to suggest that any or all of the HCFC alternate blowing agents would not be technically viable in polyisocyanurate roof insulations. 5 refs., 19 figs.

44505 (LBL–27568) **Measured savings and cost-effectiveness of conservation retrofits in commercial buildings: Volume 1, Analysis and results.** Greely, K.M.; Harris, J.P.; Hatcher, A.M. Lawrence Berkeley Lab., CA (USA). Apr 1990. 38p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90016629. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this study, we examine the measured saving and cost-effectiveness of 447 commercial retrofit projects, representing over 1700 buildings. Topics include saving and cost-effectiveness by building type and retrofit strategy, savings from individual measures, peak electric demand savings, comparisons of measured vs predicted savings, the persistence of savings in the year following a retrofit, and retrofit performance by year of installation. Median annual site energy savings amounted to 20 kBtu/ft^2. Median pre-retrofit energy intensity, for all building types in the data base, was higher than that of the corresponding US stock. Changes to the HVAC system were the most popular retrofit strategy, installed in 85% to 95% of the projects in each building category (education, health, office, retail, and other). Projects in which only maintenance practices were changed typically saved 12% of their pre-retrofit consumption often using in-house labor. Projects sponsored by the

Institutional Conservation Program (ICP) included more shell measures (with long payback times) and relatively fewer HVAC and lighting retrofits than projects paid for by the building owner; for the buildings in this data set, retrofits installed after 1983 had lower savings, higher costs, and longer payback times than measures installed earlier. Very few predictions of savings (about one in six) came within 20% of measured results. Over half of our projects had multiple years of post-retrofit data; energy use continued to decrease for most of these buildings. Our research suggests that, despite significant savings and short payback times for the majority of projects, savings often fall well short of economically optimum levels. 28 refs., 8 figs., 5 tabs.

44506 (LBL–27902) **Modeling the building design process and expertise.** Papamichael, K.M.; Selkowitz, S.E. Lawrence Berkeley Lab., CA (USA). Jul 1990. 24p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-9006253–1: ASHRAE annual meeting, St. Louis, MO (USA), 9-13 Jun 1990). Order Number DE90015311. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A model of the design process and related knowledge and expertise is applied to develop an advanced, computer-based, Building Design Support Environment (BDSE). The BDSE will support building design from the initial schematic phases, through working drawings and specifications, to a building's construction, occupancy, and use. The BDSE will consist of imaging, simulation, and expert systems software, linked in a multimedia environment containing handbooks, product catalogs, and case studies. The structure of the BDSE is presented with emphasis on modeling the building design process and related knowledge. All BDSE modules will operate on three common hierarchical data structures that describe the building, its context, and its performance. The inter-relations among the BDSE modules are compatible with the iterative nature of the design process. An issue based information system (IBIS) will be used to fully record the design process so that it will be transparent and retraceable. Presentation of the structure of the expert system module emphasizes the identification, organization, and application of appropriate building design knowledge. Finally, methodology for acquiring knowledge to develop a prototype knowledge base for designing fenestration systems is presented, along with preliminary findings and future plans. 15 refs., 10 figs.

44507 (ORNL/M–1226) **Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE Office of Buildings and Community Systems: Monthly progress report, June 1990.** Burn, G. (comp.). Oak Ridge National Lab., TN (USA). [1990]. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90014762. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months.

44508 (PB–90-233800/XAB) **Conventional research house heating characterization test results. Topical report, January-May 1989.** Leslie, N.P.; Hedrick, R.L.; Ghassan, P.G. Chamberlain Mfg. Corp., Niles, IL (USA). GARD Div. Apr 1990. 77p. Source: NTIS, PC A05/MF A01.

See also PB–89-230619.

Baseline heating characterization tests were conducted at GRI's Conventional Research House in Chicago, Illinois. A commercially available constant speed blower unit with a 15 KW electric duct heater was used as the baseline heating system. The baseline operating strategy was continuous heating with a central thermostat setpoint of 72 F. The research house was moderately furnished to approximate conditions of occupancy for a family of three. Occupancy and appliance simulation protocols were implemented in accordance with GRI's Research House Utilization Plan throughout the test period. Appliance use simulation was conducted on Mondays only. A data acquisition system monitored approximately 150 data channels on a minute by minute and hourly basis to characterize comfort, energy consumption and dynamic response of the baseline system. The heating system maintained good comfort conditions throughout the test in the upstairs rooms, but the basement remained quite cool, in the low or middle 60's. The infiltration rate ranged from 0.1 to 0.75 air changes per hour. The predicted seasonal energy consumption of the baseline system without appliance simulation was 16,100 KWH. The predicted seasonal energy consumption with appliance simulation was 14,600 KWH, a reduction of approximately 10%.

44509 (PB–90-233982/XAB) **Development of the dual-cycle absorption heat pump for residential application. Final report, October 1983-April 1990.** Ball, D.A.; Hanna, W.T.; Hindin, B.; Landstrom, D.K. Battelle Columbus Div., Washington, DC (USA). 30 Apr 1990. 327p. Source: NTIS, PC A15/MF A02.

See also PB–86-157518.

The gas industry has had a long-standing objective to commercialize a gas-fired heat pump capable of providing both heating and cooling in an efficient, cost effective package. The Dual-Cycle concept was identified as having a number of attractive features that made it an attractive candidate for fulfilling the objective. The report describes the Dual-Cycle development effort including the results of prototype tests and other hardware development activities as well as the various supporting analyses conducted during the project. The principal conclusion of the project was that although the Dual-Cycle met most of its original performance and cost goals, its first cost was perceived to be too high to sustain manufacturer interest in commercialization.

44510 (PB–90-235755/XAB) **Development of a residential gas-fired absorption double-effect air conditioner/heater. Phase I final report. Appendices.** Battelle Columbus Div., Washington, DC (USA). 26 Feb 1990. 112p. Source: NTIS, PC A06/MF A01.

The project is aimed at developing a residential gas-fired absorption double-effect air conditioner/heater. These appendices include thermodynamic state points, water evaporator design, thermodynamic and thermophysical analysis of a lithium bromide/water desorber-heat exchanger system with experimental validation, and thermal/hydraulic evaluation of tubes.

44511 (PB–90-239740/XAB) **Development of a residential gas-fired absorption double-effect air conditioner/heater. Phase 1. Final report.** Battelle Columbus Div., Washington, DC (USA). 26 Feb 1990. 112p. Source: NTIS, PC A06/MF A01.

Feasibility was demonstrated in Phase I of the project aimed at developing a gas-fired absorption air conditioner/heater. The system is air-cooled and therefore does not require a cooling tower; and uses conventional absorption fluids (lithium bromide/water) in an efficient double-effect cycle not previously applied to residential systems. This economically attractive system is designed to provide simplified installation and low combustion emissions. Activities focused on cycle definition, computer simulation, preliminary system/component configuration, and evaporator-absorber proof-of-principle tests.

44512 (PNL–6203) **The quality of the ELCAP [End-Use Load and Consumer Assessment Program] engineering data set: Background issues.** Crowder, R.S. III; Miller, N.E. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 17p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract AC06-76RL01830. Order Number DE90015558. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Bonneville Power Administration (Bonneville) began the End-Use Load and Consumer Assessment Program (ELCAP) in 1983. Prior to beginning ELCAP, there was an abundance of information regarding total power consumption for residential structures in the Pacific Northwest, through billing records for example, and limited information regarding power consumption by various end uses (such as hot water, heating and cooling). This program, conducted for Bonneville by the Pacific Northwest Laboratory, involves collecting and analyzing hourly end-use data in commercial and residential buildings in the Pacific Northwest. The purpose of this

document is to provide background information to analyses that may use ELCAP data. In general, the ELCAP data set is extremely high in quality, but analysts should be aware of potential problems that could exist with a data set of this size. This report describes the quality of the ELCAP data and emphasizes the guidelines for data review along with limitations and suggestions regarding engineering and characteristics data including missing data values, procedures for time-stamp assignments, and incomplete integration periods. 3 figs.

44513 (PNL–7100) **The composition of a quad of buildings sector energy: Physical, economic, and environmental quantities: Physical, economic, and environmental quantities.** Secrest, T.J.; Nicholls, A.K. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 74p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90014819. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In an analysis conducted for the US Department of Energy Office of Building Technologies (OBT), the Pacific Northwest Laboratory examined the fuel type composition of energy consumed in the US buildings sector. Numerical estimates were developed for the physical quantities of fuel consumed, as well as of the fossil fuel emissions (carbon dioxide, sulfur dioxide, nitrogen oxides) and nuclear spent fuel byproducts associated with that consumption. Electric generating requirements and the economic values associated with energy consumption also were quantified. These variables were quantified for a generic quad (1 quadrillion Btu) of primary energy for the years 1987 and 2010, to illustrate the impacts of a fuel-neutral reduction in buildings sector energy use, and for specific fuel types, to enable meaningful comparisons of benefits achievable through various OBT research projects or technology developments. Two examples are provided to illustrate how these conversion factors may be used to quantify the impacts of energy savings potentially achievable through OBT building energy conservation efforts. 18 refs., 6 figs., 16 tabs.

44514 (RPC–649U4587) **Proportional control system for forced-air electric furnaces.** Danisch, L.A. Research and Productivity Council, NB (Canada). Jan 1990. 102p. (CE–03112). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Forced-air electric furnances are simple, reliable, safe, compact, easy to install, and efficient. However, they are sometimes not chosen by homeowners because they can be a source of drafts, noise, and uneven temperatures. This report describes a low-cost control modification that improves the comfort of occupants using these furnaces. Furnaces were modified so that the fan ran continuously at a reduced speed. In the majority of installations, most heat for the house was supplied by one element. An even flow of heat was maintained by rapidly cycling the element on and off with a solid-state proportional control system originally designed for electric baseboard heat. When external sensors sense that the single element cannot heat the house, the furnace reverts to normal, multi-element staged control with high fan speed. The advantages are greatest in homes with moderate heat loss. Newer, R-2000 homes may still benefit from reduced noise levels. In addition to advantages of comfort, the control system has the potential to reduce peak loads on the local distribution systems. All components used in this modification are available at low cost from local suppliers. The modification can be applied to existing furnaces or could be incorporated in new furnaces. 5 refs., 32 figs., 18 tabs.

44515 (SERI/TP–255-3537) **Evaluation criteria and test methods for electrochromic windows.** Czanderna, A.W. (Solar Energy Research Inst., Golden, CO (USA)); Lampert, C.M. Solar Energy Research Inst., Golden, CO (USA). Jul 1990. 48p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093 ;AC03-76SF00098. Order Number DE90000334. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Report summarizes the test methods used for evaluating electrochromic (EC) windows, and summarizes what is known about degradation of their performance, and recommends methods and procedures for advancing EC windows for buildings applications. 77 refs., 13 figs., 6 tabs.

44516 **IEA international cooperative projects on hospital energy management and airflow within buildings.** Harrje, D.T. (Princeton Univ., NJ (USA)). pp. 341-346 of Strategies for reducing natural gas, electric and oil costs. Association of Energy Engineers, Atlanta, GA (USA) (1990). (CONF-891028–: 12. world energy engineering congress, Atlanta, GA (USA), 24-28 Oct 1989).

This paper summarizes the international investigations being conducted on how to proceed in achieving energy conservation and acceptable air quality in hospitals. The author describes findings and outlines future activity results.

44517 **The environmental and economic benefits of avoided energy consumption in the buildings sector.** Nicholls, A. (Battelle Pacific Northwest Lab., Richland, WA (USA)); Secrest, T.; Abel, F. pp. 329-340 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). DOE Contract AC06-76RL01830. (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

The mission of the Office of Buildings and Community Systems (OBCS) of the U.S. Department of Energy (DOE) is to lead a national effort to achieve the maximum, cost-effective energy productivity in the buildings sector. To this end, OBCS sponsors research, development, and technology transfer across a broad array of building and community systems areas. For example, OBCS is funding research into the development of more efficient HVAC equipment, tighter building envelopes, and improved district heating and cooling systems. OBCS has estimated that successful commercial development and consumer adoption of these technologies in the buildings sector could save as much as 11 quadrillion Btu (quad) of primary energy per year by the year 2010 compared with a no OBCS base case. The objective of this paper is to estimate, in broad terms, the environmental and economic impacts to the nation from energy savings of this magnitude. The analysis indicates that such energy conservation provides a number of substantial benefits to the United States.

44518 **Advanced lighting technologies products.** Verderber, R.R. (Lawrence Berkeley Lab., CA (USA)). pp. 527-530 of Strategies for reducing natural gas, electric and oil costs. Association of Energy Engineers, Atlanta, GA (USA) (1990). DOE Contract AC03-76SF00098. (CONF-891028–: 12. world energy engineering congress, Atlanta, GA (USA), 24-28 Oct 1989).

This paper presents suggestions made by a panel of lighting professionals for identifying lighting technologies that would reduce power demand and energy use but have not yet reached their full market potential. The author discusses the advanced lighting technologies available today and which may be used more extensively in the future.

44519 **Planning building energy conservation research in the U.S.** Abel, F. (Buildings and Community Systems, U.S. Dept. of Energy, Washington, DC (US)); La Montagne, J. pp. 3.111-3.118 of Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 3. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1988). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

In the U.S., the federal government plays a key role in the development of energy conserving technologies and practices for buildings. The Office of Buildings and Community Systems (BCS) provides federal leadership for both private and public sector activities in building energy conservation. The federal role in recent years has been largely limited to the development of technical options; behavioral and institutional factors are considered only to the extent necessary to inform the research planning process. According to the author planning in the U.S. requires dealing with uncertainties regarding the federal approach to energy conservation; this can change, often dramatically, with changes in administrations or changing economic and energy conditions.

44520 **An analysis of private sector input on buildings energy conservation R and D needs.** Farhar, B.C. (Colorado State

Univ., Fort Collins, CO (US)); Abel, F.H. pp. 3.95-3.102 of Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 3. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1988). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

Federal government-sponsored research on technologies to improve the energy efficiency of buildings has been ongoing in the United States. As part of the process of identifying appropriate and useful technologies to pursue, routine and special reviews. These reviews solicit expert opinion about the research needs for energy efficient buildings form the private sector, universities, and public organizations. Opinions and recommendations resulting from these reviews have been directed at both the process of conducting research and the content of what should be done. Also, reviewer comments have concerned themselves with both short-term (the primary emphasis) and long-term approaches. Some of the reviews have been organized by DIE and others have been carried out by other independent public and private organizations. Both general and specific results from the reviews may apply to other countries and selected ones are presented. In particular, the authors describe some major technologies for buildings with significant energy savings potential by the year 2000.

44521 Assessing options for controling indoor air quality in new energy-efficient homes. Foley, L.O. (Battelle, Pacific Northwest Lab., Portland, OR (US)). pp. 3.9-3.16 of Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 3. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1988). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

Improving the energy-efficiency of buildings represents a valuable and low-cost energy resource, and an energy option for the year 2000 is to acquire that resource. Specifically, that means to buy it just as one buys power from a coal plant; test it; and refine it to make it more flexible, reliable, cost-effective, and environmentally safe. One potential problem with this resource is a degradation of indoor air quality (IAQ) when houses are tightly built without adequate mechanical ventilation. It is necessary, therefore, to ensure that adverse environmental and health impacts associated with this resource are prevented or minimized. This paper report reports on how the Pacific Northwest Lab is addressing this particular issue.

44522 Beyond the year 2000: international building energy conservation technology. Smith, J.A. (Building Systems Div., U.S. Dept. of Energy, Washington, DC (US)); Rivera, J.D. pp. 4.31-4.40 of Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 4. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1988). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

This paper presents an overview of work being prepared for the IEA program on energy conservation in buildings and community systems. It touches on the tremendous potential for energy conservation in buildings that will be constructed in the next century. It explores questions that are already being asked within research programs of participating IEA countries and raises additional questions that should be asked. It also explores the many categories of technology that will influence the design of buildings of the future. Finally, it presents some predictions of how buildings of the future will look and operate.

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Refer also to citation(s) 44426, 45027

44523 (AD-A–221088/8/XAB) **Propulsive efficiencies of magnetohydrodynamic submerged vehicular propulsors. Final report.** Brown, S.H.; Walker, J.S.; Sondergaard, N.A.; Reilly, P.J.; Bagley, D.E. David Taylor Research Center, Bethesda, MD (USA). Apr 1990. 66p. (DTRC–90/009). Source: NTIS, PC A04/MF A01.

Magnetohydrodynamic (MHD) ship propulsion is the process of propelling a vehicular structure by a seawater electromagnetic pump. This propulsion system can be applied to a surface ship or a submerged vehicle; however, in this work only submerged vehicles at depths where wave effects can be neglected were considered. Although a number of different arrangements for a MHD propulsion system are possible, the general characteristics of such systems are most easily determined by a simple, ideal MHD rectangular duct of constant cross-sectional area. A mathematical model was developed for calculating the propulsive efficiencies of such a rectangular duct propelling a submerged vehicle. Numerical propulsive efficiencies are presented in terms of many different parameters. Assumptions were generally made in the model that tend to maximize the propulsive efficiency of the MHD system. Thus, the propulsive efficiencies calculated from the model overestimate the efficiencies of the corresponding real MHD propulsion system. These numerical results can be used for engineering estimates of the propulsive efficiencies of real MHD propulsion systems.

44524 (CB–2017) **Recycled asphalt paving, McGivney-Astle, N.B.** Eastern Paving Ltd., Moncton, NB (Canada). 1983. 45p. (CE–02961). Source: CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

In 1981 the New Brunswick Department of Transportation (NB-DOT) called for tenders on a 6.7 km road project which was to include the recycling of existing pavement and the contract was awarded to Eastern Paving Ltd. The existing pavement was ripped, loaded onto trucks, delivered to the processing site, crushed and stockpiled with protection from rain. Samples of virgin aggregate, local sand, and crushed, recycled asphalt paving were analysed by the NB-DOT central laboratory. The lab also tested possible mixes and ultimately provided an optimum design which contained 50% recycled asphalt pavement. Project accounting indicates the 50/50 mix was 19% less expensive to produce than a 100% virgin mixture. In addition an amount of surplus reclaimed pavement almost equal to that used in the project remains stockpiled. With a doubling of the ownership cost to allow for maintenance and upgrading over a ten year period, and without consideration of the value of the stockpiled pavement remaining, the hardware investment shows a payback period of 2.5 years. Environmental pollution, in the form of blue smoke emissions, was slightly more than expected but should be greatly reduced or eliminated by minor plant modifications and increased production rates. Elements of concern for future pavement recycling projects are sub-base contamination when removing oil pavement; estimating the gradation of aggregates in recycled pavement and consequent virgin aggregate requirements; the moisture content of recycled asphalt paving; stockpile consolidation; crushing procedures; and moisture content allowable in the product mix. 19 figs., 2 tabs.

44525 (FERIC–TP10081E) **Energy consumption of heavy road vehicles: Field parameter measurements and cross-impact analysis: Summary report.** Ljubic, D.A.; Nader, J.; Provencher, Y. Forest Engineering Research Inst. of Canada, Pointe Claire, PQ (Canada). Apr 1989. 45p. (MICROLOG–90-04097). Source: PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report summarizes the results of three years' research on factors which influence the energy consumption of heavy road vehicles (trucks). The relevant factors are grouped into a system called SICMER (system of interrelations among drivers, machine, environment, and road). Certain relationships have become evident from the analysis of this system. These relationships touch on several aspects: energy transformation in the engine, energy transmission to the wheels, energy balance between tires and road, complex movement of articulated vehicles, and the influence of the driver's technique. Each of these aspects has been studied in its natural environment. Some comparisons of fuel consumption are

presented in the following cases: differences in drivers' techniques; different combinations of the semi-trailer undercarriage; and different road surfaces and profiles. Examples of results of these comparisons include a 25% difference in fuel consumption between identical trips on the same route with the same truck, the difference being attributable to driving techniques alone; lower fuel consumption on trucks with self-steering axles, as compared to trucks with rigid spread axles; and the significant effect on fuel consumption caused by grades and curves. 22 figs., 5 tabs.

44526 (ORNL–6622) **Energy efficiency improvement potential of commercial aircraft to 2010.** Greene, D.L. Oak Ridge National Lab., TN (USA). Jun 1990. 42p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC05-84OR21400. Order Number DE90014767. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Aircraft are second only to motor vehicles in the use of motor fuels. Furthermore, air travel is growing twice as fast as highway travel. Clearly, the importance of energy use by commercial aircraft will continue to increase. Since 1970, air travel has more then tripled, but the growth of fuel use has been restrained by a near doubling of efficiency, from 26.2 seat miles per gallon (SMPG) in 1970 to about 49 SMPG in 1989. This paper explores the potential for future efficiency improvements via the replacement of existing aircraft with "1990's generation" and "post 2000" aircraft incorporating advances in engine and airframe technology. Today, new commercial passenger aircraft deliver 50–70 SMPG. New aircraft types scheduled for delivery in the early 1990's are expected to achieve 65–80 SMPG. Industry and government researchers have identified technologies capable of boosting aircraft efficiencies to the 100–150 SMPG range. Under current industry plans, which do not include a post-2000 generation of new aircraft, the total aircraft fleet should reach the vicinity of 65 SMPG by 2010. A new generation of 100–150 SMPG aircraft introduced in 2005 could raise the fleet average efficiency to 75–80 SMPG in 2010. In any case, fuel use will likely continue to grow at from 0.8%/y to 1.8%/y through 2010. 35 refs., 7 figs., 9 tabs.

44527 (ORNL–6626/S1) **Light-duty vehicle summary: First six months of model year 1990.** Williams, L.S. (Tennessee Univ., Knoxville, TN (USA)); Hu, P.S. Oak Ridge National Lab., TN (USA). Jul 1990. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90014816. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document brings you up to date on the most recent fuel economy and market share data for the new light-duty vehicle fleet. Model year 1990 fuel economies are weighted based on the sales of the first six months of model year 1990 (from September 1989 to March 1990). Sales-weighted fuel economy of all new automobiles decreased in the first six months of model year 1990, from 28.0 mpg in model year 1989 to 27.7 mpg. The compact, midsize, and large size classes, which together claimed 75% of the new automobile market, each showed fuel economy declines of 0.4 mpg or more. Unlike automobiles, new 1990 light trucks showed an overall 0.4 mpg gain from model year 1989. This increase was primarily due to the increased fuel economy of the small van size class. In the first half of model year 1990, small van replaced small pickup as the second most popular light truck size class. Although the fuel economy of light trucks improved, the larger market share of automobiles in the light-duty vehicle market (automobiles and light trucks combined) and the decreased fuel economy in automobiles resulted in an overall reduction of 0.2 mpg for the entire light-duty vehicle fleet in the first half of model year 1990. Also, in the first half of model year 1990, light trucks claimed more than 33% of the light-duty vehicle market–a considerable increase from the 19.8% share in 1976. 9 figs., 18 tabs.

44528 (PB–90-216417/XAB) **Development of standard transit profiles for Texas. Technical report (Final), September 1988-November 1989.** Bullard, D.L. Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst. Nov 1989. 256p. (TTI–2-10-89-2005-1F). Source: NTIS, PC A12/MF A02.

An extensive amount of financial and operational data on the public transit systems of Texas is presently being published by a variety of governmental agencies and industry associations. However, the manner in which much of the data is collected and published reduces its potential usefulness to transit operators and planning agencies. In response to this problem, standard transit system profiles were developed for the eighteen municipal systems of Texas. The transit system profiles are intended to include a range of financial, operational and performance variables in order to provide an overview of each system's characteristics. The development of these profiles will allow transit operators and planning agencies to monitor trends and evaluate changes in a transit system's performance over time, and compare the financial and operational performance of one agency with that of similar operations in the state.

44529 (PB–90-224833/XAB) **Research in bus and rail transit operations.** Chatterjee, A.; Wegmann, F.J.; Ceder, A.; Levinson, H.S.; Hollander, A. National Research Council, Washington, DC (USA). Transportation Research Board. 1989. 100p. (TRB/TRR–1221). Source: NTIS, PC A05/MF A01.

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The 10 papers in the report deal with the following areas: Private Sector Involvement in Sponsoring Sunday Bus Service; Optimal Design of Transit Short-Turn Trips; New York City's Unfranchised Buses: Case Study in Deregulation; Critical Factors in Planning Multimodal Passenger Terminals; Use of Travelers' Attitudes in Rail Service Design; Driven, Attended, and Fully Automated Transit; Qualitative Comparison; Impact on Transit Patronage of Cessation or Inauguration of Rail Service; Use of Productivity Factors in Estimating LRT Operating Costs; Simulation Study To Evaluate Spare Ratios in Bus Transit Systems; Statistical Evaluation of Spare Ratio in Transit Rolling Stock.

44530 (PB–90-225376/XAB) **Minnesota transit laboratory: Phase I conclusions. Improving transit service. Final report, April 1987-December 1988.** Stephanedes, Y.J.; Doumbia, B. Minnesota Univ., Minneapolis, MN (USA). Dept. of Civil and Mineral Engineering. Jul 1989. 102p. Source: NTIS, PC A06/MF A01.

The desire to increase the attractiveness and use of transit has led the Minnesota Department of Transportation to set up a Laboratory for developing improved service and encouraging innovation in transit. Prior to seeking improvement of transit operations and the attractiveness of public travel, the problems of the transit industry had to be clearly defined. To that effect, an initial set of eight problem areas was defined and prioritized on the basis of short- and long-term. To conduct the analysis, a well known and proven methodology, the Delphi Technique, was used.

44531 (PB–90-225608/XAB) **Development of standard transit profiles for Texas. Final technical report, September 1988-November 1989.** Bullard, D.L. Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst. Nov 1989. 292p. (TR–2005-1F). Source: NTIS, PC A13/MF A02.

See also PB–90-130378.

An extensive amount of financial and operational data on the public transit systems of Texas is being published by a variety of governmental agencies and industry associations. However, the manner in which much of the data is collected and published reduces its potential usefulness to transit operators and planning agencies. Standard transit system profiles are developed for the eighteen municipal systems of Texas. The development of the profiles will allow transit operators and planning agencies to: monitor trends and evaluate changes in a transit system's performance over time; and compare the financial and operational performance of one agency with that of similar operations in the state.

44532 (PB–90-231119/XAB) **National transportation strategic planning study. Staff report (Final).** Department of Transportation, Washington, DC (USA). Mar 1990. 533p. Source: NTIS, PC A23/MF A03.

The study provides an overview of the U.S.'s transportation system and identifies future investments required to maintain and develop the infrastructure. The first four chapters discuss the impact that demographics, economic factors, the energy supply, and the environment will have on the supply and demand for transportation services during the next 25 to 30 years. The succeeding five chapters then describe the setting in which infrastructure issues must be reviewed, including current status of transportation, international issues, regulatory issues, safety and security factors,

and the potential of new technologies. The remaining chapters address the various components of the transportation system on a mode by mode basis. Appendices examine the transportation issues of five urban regions around the country, and federal subsidies provided to transportation.

44533 (PB–90-235425/XAB) **Light-duty automotive technology and fuel-economy trends through 1990. Technical report.** Heavenrich, R.M.; Murrell, J.D. Environmental Protection Agency, Ann Arbor, MI (USA). Jun 1990. 32p. (EPA/AA/CTAB–90/03). Source: NTIS, PC A03/MF A01.

Supersedes PB–89-215396.

Trends in motor vehicle technology and fuel economy usage for light-duty cars and trucks model years 1975 to 1990 are examined. Trends by vehicle size and market segment are also included.

44534 Numerical modeling of arcjet performance. Butler, G.W. (Rocket Research Co., Redmond, WA (USA)); King, D.Q.; Kashiva, B.A. pp. 13 of AIAA, fluid dynamics, plasma dynamics and lasers conference. AIAA, Washington, DC (US) (1990). (AIAA-Paper–90-1474;CONF-9006153–: 21. AIAA fluid dynamics, plasmadynamics and laser conference in conjuction with the AIAA 25th thermophysics and heat transfer conference and the 16th aerodynamic ground testing conference, Seattle, WA (USA), 18-20 Jun

This paper describes the numerical method and the development of a low power arcjet performance model. The model incorporates a state-of-the-art nonsteady, two-dimensional, composite fluid approach and includes the effects of ohmic heating, finite-rate chemistry, thermal conduction, viscosity, and Bremsstrahlung radiation. Initial results of the simulation are presented for an arcjet operating on N2 propellant at a current level of 10 amps. 19 refs.

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Refer also to citation(s) 43847, 43873, 43933, 43939, 43964, 44027, 44071, 44084, 44086, 44118, 44202, 44212, 44213, 44243, 44451, 44474, 44496, 44503, 44572, 44575, 44576, 44578, 44625, 44626, 44698, 44821, 45187, 45355, 46290

44535 (CCOE–CE03114) **Electrotechnologies and Industry: A profitable partnership: Congress 90.** Canadian Committee on Electrotechnologies (Canada). [1990]. vp. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

A conference was held to address various issues associated with electrotechnologies, such as environmental protection, innovations in materials processing, electric heating applications, adjustable speed drive motors, electric drying and evaporation, technology assessment, and implementation of electrotechnologies. Topics of papers presented at the conference included plasma processing, solvent extraction and electrowinning, electrolytic metal production, energy efficiency, dielectric and induction heating, monitoring and control systems, demonstration programs and case studies at industrial plants, microwave drying, heat pump applications, design of cogeneration systems, electric power quality, evaluation of electrotechnologies, and electric vehicles. Separate abstracts have been prepared for 18 papers from this conference.

44536 (CCOE–CE03114, pp. 13.0-13.15) **Electrical energy efficiency of industrial electrotechnologies.** Mitchell, J.E. (Ontario Hydro, Toronto, ON (Canada)); Sanio, M.R. Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Electric heating applications are found in most industries and typically provide significant overall competitive advantages as well as energy efficiency and environmental benefits. Studies have shown the link between electricity consumed, energy intensity, and industrial productivity in various countries. Three case studies are presented to show that increased use of electricity in industrial processes typically results in an overall reduction in energy consumption as well as a reduction in energy intensity. A comparison of induction versus cupola melting in the foundry industry shows that energy costs are reduced by ca 50% by using induction heating. A comparison of industrial dryers shows that radio-frequency dryers are at least 25% more energy efficient than conventional conveyorized or can-type dryers. A comparison of coating systems demonstrates the substantial energy efficiency improvement and cost savings through the use of ultraviolet or electrobeam curing technologies. 5 figs., 3 tabs.

44537 (CCOE–CE03114, pp. 15.0-15.13) **Induction heating of paper machine rolls.** Sparkes, D.G. (The Pulp and Paper Research Inst. of Canada (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

In papermaking, a considerable advantage could be gained, in terms of energy cost, from a reduction in the moisture content of the web exiting the press section of the paper machine and entering the drying section. A new technology, called impulse drying, has been developed to achieve this reduction by heating the press roll in contact with the web. In order to maintain the impulse drying effect at the high speeds typical of commercial newsprint production, very high heat transfer rates per unit of roll surface area are required. Electrical induction heating has the high energy flux potential to be able to reach such heat transfer rates, and in addition, the heat can be generated very close to the surface of the roll. Experiments were conducted to test the effectiveness of an induction heated press roll in newsprint making. At a roll temperature of 150°C, a nip residence time of 20 ms and an ingoing solids content of 39%, the impulse dried web attained an outgoing solids content of 56% (compared to 47% for a conventionally pressed web). At this ingoing solids content, the dryer section would have 35% less water to evaporate. The electrical energy consumption during impulse drying was measured over a range of conditions, and the energy required to remove a unit quantity of water was calculated. It is demonstrated that for a typical Canadian newsprint machine, water removal could be carried out at 3.38 GJ/tonne of newsprint using impulse drying, compared to 4.6 GJ/tonne using conventional methods. The the impulse-dried paper, compared to those of conventionally-dried paper, was thinner, smoother, and stronger, but showed small losses in tear index and brightness. 6 refs., 3 figs., 3 tabs.

44538 (CCOE–CE03114, pp. 18.0-18.12) **High efficiency motors and drives.** Henriques, G.D. (B.C. Hydro, Vancouver, BC (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

An overview is presented of developments in electric motor technology, including standardization, improved materials, and microprocessor controls. Such developments have resulted in motors with high energy efficiencies. In addition, the development of variable speed drives has resulted in greater operational efficiencies for motors used in industrial applications, since the motor output can be matched to a particular load demand more easily. Examples of applications of high efficiency, variable speed ac or dc drives are presented, illustrating the energy and cost savings possible with such equipment. These applications include water pumping, oil pumping and pipelining, ore conveying, centrifuging, paper making, and transportation via aerial ropeway. The contribution of solid-state starters to the problem of starting current inrush is also discussed. 11 refs., 1 tab.

44539 (CCOE–CE03114, pp. 19.0-19.18) **Variable speed drives on aerial coolers.** Stromer, R. (Esso Resources Canada, Calgary, AB (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114).

In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Aerial coolers provide an ideal application for variable frequency drives, compared to fixed or 2-speed motor applications with mechanical control devices. The design considerations for fixed- and variable-speed applications are presented, including fan size, motor size, motor inertia, acceleration time, motor cooling, explosion proofing, air density, and electrical controls. Energy costs of the 2 types of drives are compared. The variable speed drive adjusts the electric demand in accordance with the required cooling, and the highest demand will be at high ambient temperatures. However, this demand will be lower than the highest demand of a fixed-speed drive at low ambient temperatures. An analysis of costs for a propane gas cooler shows that although the variable speed drive has a higher initial cost, payback is under 2 years (and as low as 1.22 years for the variable frequency drive). Other advantages of variable speed drives include enhanced product quality and uniformity due to controlled process cooling, prolonged equipment lifetime, reduced maintenance cost, and noise reduction. 5 figs., 1 tab.

44540 (CCOE–CE03114, pp. 20.0-20.B.6) **Adjustable speed drive demonstration at the Scott Paper Mill.** Persson, E. (H.A. Simons Ltd., Vancouver, BC (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

A study was conducted to demonstrate the energy savings possible when using an adjustable speed drive with throttling valve, in controlling the stock flow at a paper mill. The motor and pump were operated directly on-line at 60Hz for two months with flow control by throttling valve. During the remainder of the month test period, the same motor and pump were operated from an adjustable frequency inverter at adjustable speed, with the throttling valve fully open. During the entire test period a computer logged data on drive input power, flow, consistency and other variables. This data were analyzed and the energy savings calculated. The study confirmed that adjustable speed drives can payback the additional first cost in less than two years, provided they are operated at low flow rates most of the year. 6 refs., 5 figs., 2 tabs.

44541 (CCOE–CE03114, pp. 21.0-21.17) **Performance and design issues for large adjustable speed drive motors in industrial applications.** Kleiner, F. (Siemens AG (German Democratic Republic)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

With the availability of reliable solid state frequency converters of practically unlimited power rating, electric motor ac adjustable speed drives are an increasingly attractive alternative to mechanical drivers and dc motors on many kinds of rotating equipment. Although there is a strong demand for such electric drives in the manufacturing, transportation equipment and metals & mining industries, the focus of this review is on centrifugal pump and compressor drives in the natural gas, chemical, petrochemical process industries. Emphasis is on the very high end of the power and speed rating spectrum and the electrical and mechanical design aspects of the special synchronous motors that are employed for inverter duty. In particular the differences between line-fed fixed speed synchronous motors and converter-fed adjustable speed motors are addressed. Actual application examples of such machines, typical performance characteristics, side effects of their use and economic factors are presented. 8 refs., 14 figs., 1 tab.

44542 (CCOE–CE03114, pp. 22.0-22.17) **Operating experience of two 17,000 KW ASD electric motor compressor units.** Belanger, Y. (Petromont Inc., Varennes, PQ (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

A plant modernisation program was undertaken at a Quebec petrochemical plant. After detailed studies, it was found that substantial cost savings could be achieved if the steam turbines were replaced with electric motors. The order for the drive system was placed with Siemens Electric and at the end of Oct, 1986 the drives were put in operation. As the two drives are the heart of the plant, reliability and availability were a high priority. The motor design had to include the particularities of the location and the small footprint of the steam turbine foundations. The motors had to provide the same speed and power as the steam turbines. The converters and the 25 kV switchgear are installed in a separate building. The harmonic filters and power factor correction equipment are installed in the yard. The high speed drive takes about 20 minutes to go on-line from a cold start vs the 4 hours required for the turbines. The initial start-up was done in five weeks and most shut-downs during this time and the first few months of operation occurred because of conventional devices like limit switches and flow switches. With more operating experience, some of the trip conditions were changed to alarms only. During the start-up extensive training was given to the maintenance personnel. Although there were some problems, the major benefits are the flexibility of operation, better performance and energy savings. 4 figs.

44543 (CCOE–CE03114, pp. 23.0-23.10) **An overview of drying and concentrating applications.** Strack, J.T. (Ontario Hydro, Toronto, ON (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

It is estimated that about 25% of the total energy purchased by the manufacturing sector in Canada is used for drying and concentrating. In recent years, there has been a trend toward using various electrotechnologies for drying and concentrating, since electricity-based techniques have been found to provide benefits such as faster processing times, lower energy costs, and better controllability. A review is presented of currently used electrotechnologies and some future beneficial developments are identified. Electrical resistance and infrared drying generally do not offer lower energy costs, but can be attractive for other reasons, notably in drying thin products and coatings. Microwave and radio-frequency heating is a relatively new technology being considered to eliminate many of the bottlenecks in drying processes. This type of heating can speed drying by providing energy to the interior of a product, which speeds moisture migration to the surface. Industrial heat pumps are used advantageously at about 200 sites in Canada, and two applications are noted: dehumidification and mechanical vapor recompression. 23 refs., 6 figs.

44544 (CCOE–CE03114, pp. 24.0-24.10) **Microwave rendering process.** Husain, H. (Wardrop Engineering Inc., Winnipeg, MB (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Microwave rendering offers the potential for solving the bulk of the problems associated with conventional rendering processes. Direct delivery of energy results in easy separation of fat and protein, and low temperature evaporation of water. A significant portion of the water is removed from the system in liquid form, thus energy requirements can be lower. Tests have shown that a higher quality fat with a price advantage of 5.5 cents per kg is produced. Processing times are shorter, equipment sizes are smaller, there are no noxious odors, and the process is clean and simple to operate. An overview of the Canadian food industry indicates that

microwave rendering has applications in processing meat, poultry, and fish, and its mode of application can be designed to suit a specific feedstock need. Cost and revenue comparisons are provided for a poultry plant and a meat plant, based on scenarios for actual processing plants in Manitoba. The comparisons show that capital costs for conventional and microwave rendering plants are comparable; however, the microwave plant has higher revenue, lower operating cost, and a shorter payback period on investment. 1 fig., 3 tabs.

44545 (CCOE–CE03114, pp. 25.0-25.7) **Drying of clay and ceramic bodies.** Oda, S.J. (Ontario Hydro, Toronto, ON (Canada)); Balbad, I.S.; Woods, B.G.; Barber, B.T. Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

A review of research and demonstration projects concerned with ceramic drying illustrates the potential of electrotechnologies for improving industrial processes and reducing energy consumption. Most of these projects involved microwaves, so an explanation of microwave drying is provided. Other technologies used include infrared heating, radio-frequency drying, and drying by means of heat pump dehumidification. The benefits from using electrotechnologies included reduced drying times, increased production capacity, lower storage requirements for molds, and enabling the implementation of automation. The electrotechnologies can also be combined with conventional drying processes to optimize process improvement at minimal cost. 2 refs., 2 figs., 1 tab.

44546 (CCOE–CE03114, pp. 26.0-26.12) **Freeze concentration.** Amarnath, K.R. (Electric Power Research Inst., Palo Alto, CA (USA)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Freeze concentration is a developing technology which separates mixed liquids by converting one or more of them to a solid. Freezing is more energy efficient in many applications than either evaporation or distillation, the most common industrial separation methods used today. A study on the industrial applications of freeze concentration showed tha annual heat energy consumption will decrease an estimated 1.4 quads if industry replaces evaporation and distillation in every feasible case where freezing can be used. This wide-spread use of freeze processes, which are typically electricity-driven, will increase annual industrial electricity consumption by 20 billion kWh. Another study on freeze concentration of dairy products explored freeze concentration as a process to replace thermal evaporation in the dairy industry. The goals of the study were to save energy by converting concentration processes to an efficient, electrically powered, refrigeration system, and to create higher quality and innovative dairy products. A small freeze concentration pilot plant was used to concentrate products for quality comparisons. Data were correlated to compare operating economics of freeze concentration to thermal processes. Preliminary conclusions show the quality of freeze concentrates superior to the fresh feedstock in sensory and functionality tests upon reconstitution. Laboratory testing showed equal or superior quality in resulting spray dried powders from freeze concentrates. Freeze concentration was shown to be economically competitive with thermal processes. 2 tabs.

44547 (CCOE–CE03114, pp. 28.0-28.17) **Evaluation and comparative energetic efficiency of a MVR [mechanical vapor recompression] evaporator for dairy products at Lactantia Ltee.** Lemay, O. (Hydro-Quebec, Montreal, PQ (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

A new evaporator using mechanical vapor recompression (MVR) was installed at a Quebec dairy products plant, replacing 3 older steam-driven evaporators. The performance and cost benefits of the new system were evaluated. As compared to the original equipment, the MVR system achieved energy savings of 78%, or about $600,000 per year in costs. A comparison of the coefficients of performance of the 2 systems shows that the MVR system is 6-8 times more efficient. Payback period for the new system is estimated at 3.5 years. 2 figs., 4 tabs.

44548 (CCOE–CE03114, pp. 29.0-29.6) **Barriers and incentives in electrotechnology game: Building a win-win situation.** Samotyj, M.J. (Electric Power Research Inst., Palo Alto, CA (USA)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

The industrial load tends to be a utility's best load. While the residential and commercial sector's high daytime energy use requires the expensive cycling of peaking units by utilities, industries often operate nearly continuously, which allows their demand to be served on a more economical baseload level. Unfortunately, the industrial customer base of utilities has been slowly eroding. Faced with increased energy and labor costs and the expense of complying with stricter environmental regulations, many industries lose market share and produce fewer goods, and also use less electricity. As the industrial load erodes, the peaky residential/commercial demand becomes a greater proportion of a utility's total load, which increases the cost of producing electricity. Industrial customers are then faced with higher electricity costs and become even less competitive than before. The overall result is an insidious downward spiral. Electrotechnologies offer a means of breaking this spiral. Electricity is unique in the flexibility and efficiency of its use, and when applied to industrial processes it can improve productivity, quality, and value in ways that are not possible with other energy forms. Laser welding and cutting, mirowave drying, induction heating, and electric arc furnaces for steelmaking are examples of electrotechnologies that have created new industrial opportunities.

44549 (CCOE–CE03114, pp. 30.0-30.21) **Pinch technology applications: Selecting and evaluating cogeneration systems.** McMullan, A.S. (Linnhoff March, Inc., Leesburg, VA (USA)); Rutkowski, M.A. Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

The conventional approach to selection of a cogeneration system for a particular application involves treating the utility system and process separately. Pinch technology, a recently developed process design tool, provides new insights into the task of cogeneration system design by allowing the utility system and process to be considered as a single entity. This ensures that the true process heating requirements, rather than the existing heat loads, are met by the cogeneration system while maximizing the thermodynamic efficiency of the total system. The two steps in the analysis consist of: determining the true process heating duties and utility temperature requirements; and selecting a utility system which matches those true requirements. The pinch technology approach is illustrated by an analysis of a corn processing operation. A number of different cogeneration options are compared and evaluated according to critieria such as maximizing power generation, minimizing capital cost, and improving heat recovery. 1 ref., 14 figs., 3 tabs.

44550 (CCOE–CE03114, pp. 31.0-31.21) **The quality of power.** Ryan, M.C. (Ontario Hydro, Toronto, ON (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Power quality is used to define the degree of compatibility between electrical devices and power systems. Poor quality power largely manifests itself as disturbances to the voltage waveform. These problems are introduced into power systems primarily as a result of improper grounding and wiring as well as incompatibility of customer equipment with the power system. The quality of power is becoming an increasingly important and complex issue for the following reasons. Equipment using highly sensitive components which are intolerant to deviations of the power supply is in widespread use. Examples include computers and programmable controllers. There has been an increase in the use of power electronic equipment which produces disturbances that may detrimentally affect the operation of sensitive loads. Electrical users have a higher dependency on, and thus higher expectations of, the electrical system than they did in the past. The experiences of electric utility customer service personnel and consultants indicate that problems associated with the quality of power are increasing significantly. An important issue that needs to be addressed is the question of who should pay to resolve and/or prevent power quality problems. A long term soluton would include the adoption of standards, guidelines and penalties for incompatible electrical systems. This would not, however, address the immediate power quality problems that customers face. Some insights are provided concerning the significance and causes of poor power quality. Means of presenting and mitigating voltage disturbances are suggested, and some recent Canadian efforts to address the relevant issues, are outlined. 3 refs., 4 figs., 2 tabs.

44551 (CCOE–CE03114, pp. 32.0-32.26) **Adjustable speed drive application evaluation methodology.** Poole, J.N. (CRS Sirrine Engineers, Inc., Raleigh, NC (USA)). Canadian Committee on Electrotechnologies (Canada). [1990]. -. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90*. Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Electronic adjustable speed drives for industrial electric motors can save energy, lower maintenance costs, and improve product quality. By providing a variable frequency voltage to ac motors, the speed of the motors can be controlled and matched to process requirements. The characteristics of typical drives, including silicon controlled rectifier converters or inverters, are described, and their efficiency and power factor curves are presented. Criteria for selection of a variable speed drive are outlined, along with the possible energy savings. A good candidate for a variable speed drive application is an installation with a high number of annual operating hours and a medium to large power requirement, and in which there is a high degree of throttling for a high percentage of the operating hours. Examples of applications include municipal water pumping and waste treatment systems, industrial mixing and drying equipment, cooling tower fans and pumps, and boiler fans and pumps. Two case studies are used to illustrate the benefits of using adjustable speed drives. A fan on a recovery boiler at a paper mill was retrofitted with an ac motor and variable frequency drive system, with a net annual energy cost saving of $338,000. At a municipal water pumping station, two pumps were fitted with adjustable speed drives and the estimated energy cost savings were $184,600 per year. 25 figs.

44552 (DOE/CE/15437–T4) **Steam generator with integral down-draft dryer: Project status report, April 1–June 30 1990.** Hochmuth, F.W. Hochmuth (Frank W.), Brewer, ME (USA). Jul 1990. 37p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15437. Order Number DE90015381. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the fourth quarterly report on the "Steam Generator with Down-draft Dryer" project, Department of Energy grant Number FG01-89CE-15437. Although a significant amount of activity and progress occurred during the past quarter the program is slightly behind schedule. It is expected however that tasks numbered one through four, as listed below will be completed by July, 1990. The project is designed to determine, to the extent possible, the technical and economic possibilities of the patented furnace design that would utilize high temperature furnace gases to dry wet fuel prior to its delivery to a burning grate. The novelty of the process is that it takes place in a down-draft pass that is integral to the furnace and requires no mechanical means to create and maintain gas recirculation. It is hoped that the information gained from the project will lead to a protype installation and/or license agreement with a boiler manufacturer or fuel burning equipment supplier. 15 figs., 2 tabs.

44553 (DOE/ID/12793–1) **Study of new applications for heat pumps in the brewing industry: Phase 1: Final report.** Kinetics Technology International Corp., Monrovia, CA (USA). Mar 1990. 57p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-88ID12793. Order Number DE90015524. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document is a progress report for an investigation into the utilization of heat pumps in the brewing industry. Heat pumps in Miller Brewing's in Fulton, New York and Irwindale, California, were evaluated on performance and economics. 21 figs., 13 tabs. (FSD)

44554 (EGG-M–90294) **Metal recovery from industrial sludges.** Troescher, P.D.; Espinosa, J.M.; Hotz, N.J.; Janikowski, S.J.; Ugaki, S.N.; Wikoff, P.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1990]. 11p. Sponsored by U.S. Department of Defense. DOE Contract AC07-76ID01570. (CONF-9007145–1: SUR/FIN '90, Boston, MA (USA), 11 Jul 1990). Order Number DE90015463. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the Metals Recovery From Industrial Sludges Program. This work being performed for the US Air Force by the Idaho National Engineering Laboratory through the US Department of Energy, Idaho Operations Office. The program objective is to develop methods to recover chromium and other metals from the sludge produced by the Industrial Waste Treatment Plant at Tinker AFB. This would reduce or eliminate the considerable costs associated with disposal of metal-bearing sludges. A literature search, market survey, and preliminary laboratory tests have been completed. Results suggest that the metals may be recovered feasibly as raw stainless steel, although penalties exist for sulfur and phosphorus contaminants. Results from biological leaching studies indicate that the Thiobacillus ferrooxidans microorganism is not effective in leaching metals from sludge. Other microorganisms naturally present in the sludge have been tested with similar results. Chemical leaching and precipitating studies were more promising at this point in the research. Phase 2 of the program, currently underway, deals with the optimization of the laboratory tests. The design and construction of a bench-scale system and a pilot-scale system will also take place in this phase of the program. In Phase 3 a full-scale process will be implemented. 10 refs., 9 tabs.

44555 (ETDE-IT–90-19) **Clean technologies in the Italian chemical industry.** Guidotti, G.R.; Castagnola, A.M. ENEA, Casaccia (Italy). Centro Ricerche Energia. May 1989. 7p. (CONF-890564–2: ISWA-conference on waste minimization and clean technology: moving towards the 21st century, Geneva (Switzerland), 29 May - 1 jun 1989). Order Number DE90514419. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at waste minimization and clean technology conference (Geneva, 29 May-1 Jun 1989).

Environmental protection strategy is slowly changing throughout the industrialized countries from the old paradigm based on the end-of-pipe controls to a new paradigm based on waste and risk reduction. This involves emphasizing regulatory and non-regulatory strategies that reduce as many wastes and pollutants as possible before they reach the end of the pipe. On behalf of the Italian Ministry of Environment, current state of the process technologies and the production of wastes in the Italian chemical industry was recently assessed in the framework of the activities of the Explorative Group for Advanced Environmental Technologies (GRETA). Attention was focused on the profitable tools for, and the current constraints to, developing and/or implementing the use of low-waste chemical technologies. This is thought indeed as the primary strategy in a hierarchy of responses to pollution, followed by recycling, to be introduced when waste reduction does not work, and end-of-pipe controls, to be only used if neither of these prove effective.

44556 (ETDE-IT–90-47) **Energy consumption trend analysis: Cement industry case study.** Cazzola, C. ENEA, Rome

(Italy). Dec 1988. 85p. (In Italian). (RTI/STUDI-STRAT–88-4). Order Number DE90514428. Source: NTIS (US Sales Only), PC A05/MF A01.

Three variables are taken into account in this energy audit/trend analysis of the cement industry in Italy. The first is determined by the establishment of a roughly linear relationship between short term production levels and energy consumption. The second variable relates energy cost incidence according to the rigidity of high energy content imputs. This is followed by a consideration of the change of production mix which could lead to variations in the use of productive technologies. The trend analysis also considers the evolution, interaction and elasticity of these variables.

44557 (EUR–12157) **The use of a mechanical vapour recompression (energy-saving) evaporator to concentrate acid casein whey: Demonstration project: Final report.** Kearney, O. (Kantoher Co-operative Agricultural and Dairy Society Ltd., Killeedy, Ballagh (Ireland)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Kantoher Co-operative Agricultural and Dairy Society Ltd., Killeedy, Ballagh (Ireland). 1989. 45p. Sponsored by Commission of the European Communities. Contract EE/410/84-IRL. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 5.

Hydrochloric acid whey is a by product of casein manufacture. It has a pH of 4.6 and a total solids content of 6.0%. The Mechanical Vapour Recompression Evaporation of Kantoher Co-Operative Creamery is used to concentrate this whey to a final total solids content of 32%. Mechanical Vapour Recompression Evaporators work on the principle that vapour leaving an evaporation stage is compressed, thus increasing its pressure and saturation temperature. This compressed vapour can then be used as heating steam in the same stage. The only extra energy required is the mechanical work of compressing the vapour, carried out by a fan operated, in the case of Kantoher, by a dc motor. The plant was installed and commissioned during the spring of 1985. Some minor problems occured at first, which were soon rectified. The plant was run on a shift basis by three operators each on an eight hour day. An average of 21,000 litres of acid casein whey was processed per hour, giving a concentrated product of 4,000 litres at 32% total solids or dry matter. The usual length of production run was 20 hours per day followed by a four hour cleaning cycle. Following this cleaning with nitric acid and caustic soda (lye) the plant continued evaporation of whey. During the summer the plant was run continually on a 7 day week 24 hour day basis.

44558 (GAO/RCED–90-23) **Hazardous waste: Contractors should be accountable for environmental performance.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 41p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

The federal government produces millions of tons of hazardous waste each year. Over the years, some of this waste has seeped into groundwater supplies and has contaminated the land. There is concern that contractors operating government facilities have little incentive to comply with federal regulations. This report examines Department of Defense and Department of Energy policies and procedures and finds that while contractors at the two agencies have been charged with similar federal violations, only DOE has a policy of paying its contractors' penalties, settlement payments, and legal expenses. This report also looks at whether fees awarded contractors have been reduced when they fail to comply with environmental regulations. Neither DOD nor DOE regulations or guidelines require that a contractor's environmental performance be evaluated in the award-fee process. Without written policies requiring environmental considerations, there are no guarantees that future award-fee decisions will include them. As a result, contractors will have few additional incentives to comply with environmental laws and regulations.

44559 (OH/RD–709U603) **Microwave-resistance heating for advanced ceramic processing.** Balbaa, I.S. Ontario Hydro Research Div., Toronto, ON (Canada). Jan 1990. 70p. (CE–03113). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Ontario Hydro Research Division, participating in a co-funded project with the Canadian Electrical Association, developed an energy efficient heating technology for processing advanced ceramics. A kiln combining microwave with electric resistance heating was designed and built to investigate the effect of this hybrid technology on production rates and energy requirements for calcining and sintering a selected number of ceramic materials. Even without any optimization, test results on the ceramics revealed significant reductions in both processing time and energy consumption. The energy required to calcine alumina and barium titanate was reduced by 18 and 66% respectively compared to conventional processing. Similarly, energy consumption was reduced by a last 50% for sintering tests. Processing times were also significantly lowered. Complete calcination of α-alumina took 72 minutes versus the 3 hours required conventionally; and, sintering α-alumina required about 90 minutes to complete compared to the 20 hours required by conventional methods. Other materials had calcination and sintering times reduced by approximately one-half. 11 refs., 9 figs., 3 tabs.

44560 (OME–90-01732) **Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.** Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. vp. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A meeting was held to discuss cogeneration experiences and prospects in Ontario. Papers were presented on cogeneration case studies and demonstrations, market opportunities, packaged systems, technology, the Cheng Cycle, market trends in the United States, gas pricing for cogeneration, gas sales contracts and energy efficiency in Ontario. Separate abstracting has been provided for 13 papers from this meeting.

44561 (OME–90-01732, pp. 1-10, Paper 10) **Cogeneration feasibility study for Tage Hansen greenhouses.** Couturier, G. (MacLaren Engineers Inc., Willowdale, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Tage Hansen greenhouse complex located in Leamington, Ontario has been identified as a potential candidate for cogeneration. Three cogeneration schemes, 150 kW, 300 kW and 400 kW, were developed and analyzed with respect to their technical and economic merits and disadvantages. By varying the capital costs of each of the three cogeneration schemes developed, the rate of return on investment (ROI) and payback periods range from 5.9% and 11 years to 17.8% and 5 years. The effect of varying fuel and maintenance costs on payback period and before tax rate of return over 15 years, for the 150 kW scheme, ranges from 15.4% and 7 years to 1.3% and 14 years. The effect of varying the per cent available waste heat utilized on the return on investment for the 150 kW option, ranges from 9% ROI at 100% available waste heat utilized to 0% ROI at 75% waste heat utilized. Cogeneration for the greenhouse is viable but economically marginally attractive. Further consideration should be given to the benefit of installing back-up standby power capability. 4 figs., 4 tabs.

44562 (OME–90-01732, pp. 1-13, Paper 9) **Cogeneration case study: Backpressure turbine generator for H.J. Heinz Company of Canada Ltd.** Hubley, K. (Monenco Consultants Ltd., St. Catharines, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and*

prospects in Ontario: Proceedings of the seminar. Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

H.J. Heinz recognized early in 1986 the potential to use a portion of their total process steam requirement to generate electricity before being used in the process. A preliminary feasibility analysis was performed. Boiler modifications were needed to increase process steam flow, which in turn would increase the amount of electrical energy produced. Only the newest boiler rated at 160,000 lb/h was considered suitable for upgrading to a higher pressure and temperature operation. Two upgrading options were considered: pressure increase to 275 psig and addition of a super heater to produce steam at 500°F; and increase pressure to 275 psig to produce dry and saturated steam. A single stage machine and a multistage machine were evaluated for the upgrading options noted previously. In addition, each option was further evaluated assuming the boiler's load factor remained unchanged or increased to the maximum level practical. The generated power ranges from 3,900,000 to 10,200,000 kWh, with the multistage machine producing the higher output. Upon a cost/benefit analysis of all the options, a single stage turbine generator coupled to the boiler producing 275 psig of dry saturated steam was recommended. 3 figs., 4 tabs.

44563 (OME–90-01732, pp. 1-11, Paper 6) **Cheng Cycle: Concepts and applications in small gas turbines.** DeVaal, J. (Cullen Detroit Diesel Allison Ltd., Surrey, BC (Canada)); Ashford, B. Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Cheng Cycle dramatically improves the efficiency, flexibility and power output of a cogeneration system with a minimal increase in mechanical complexity. In the Cheng Cycle, gas turbine exhaust heat is used to produce superheated steam in a heat recovery steam generator. This steam can either be injected into the gas turbine to greatly increase efficiency and power output, or can be used as process thermal energy. The Cheng Cycle combines and optimizes the Brayton (gas turbine) and Rankine (steam turbine) cycles using a single gas turbine as a prime mover. Controlled injection of superheated steam into the combustor section provides up to 15% greater mass flow which boosts power by up to 65%. Additionally, because the extra power is produced with only 15% more fuel consumed, electrical efficiency is increased by approximately 40%. The Cheng Cycle also offers intrinsic NO_x suppression because massive steam injection into the combustion flame zone inhibits NO_x formation by effectively cooling high temperature flame areas. The really significant feature of this patented steam injection operating cycle, however, lies in its optimization of the electrical and thermal outputs for any given set of circumstances. A comprehensive computer program has been developed, utilizing a Bailey network 90 system. This program allows the system to track various parameters and select the most economical operating point. 5 figs., 2 tabs.

44564 (OME–90-01732, pp. 1-36, Paper 5) **A cost effective and flexible industrial cogeneration system.** Schneider, P.H. (Solar Turbines Inc., San Diego, CA (USA)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper deals with industrial cogeneration, and in particular, a new combined-cycle cogeneration system which offers improved cost effectiveness and flexibility of operation. Solar Turbines Inc. offers a system based on the new steam approach. A key component with respect to reliability, availability, and reduced maintenance is the once through generator, with its corrosion resistant materials and passive water treatment. The economics are largely driven by increased performance due to higher efficiency steam cycles, with supplementary firing, and a new steam turbine. A brief background illustrating how Solar fits into the cogeneration business is also given. 22 figs., 8 tabs.

44565 (OME–90-01732, pp. 1-47, Paper 4) **Technology overview: Large gas and steam turbines.** Linden, S. van der (Asea Brown Boveri Energy Services, Inc. North Brunswick, NJ (USA)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogene:ation: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A brief history of gas turbines is provided as well as the thermodynamic principles involved. A brief description of the cogeneration cycle, the variables affecting cycle performance and the procedure for maximum fuel utilization are given. One of the many and varied applications of Cogen is illustrated. Performance synopses for various ambients is shown. Typical costs for various type plants vary from 200 $/kW for simple cycle gas turbines to 1100 $/kW and above for nuclear plants. The environmental impact of cogeneration plants is assessed in terms of pollution control points, thermal noise and flue gas. Preconditions for future power plants are identified, as well as the advantages provided by gas fired combined-cycle cogeneration plants that meet these preconditions. 43 figs.

44566 (OME–90-01732, pp. 2-16, Paper 3) **Packaged systems.** Ander, B.E. (Atlas Polar Co. Ltd., Toronto, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper deals with packaged systems for use in cogeneration plants. A brief history and description of packaged systems are given, and a discussion of the installation, economics and specific site requirements of packaged systems is provided. It is stressed that packagers, contractors and consultants must gain experience in designing, manufacturing and installing custom cogeneration packages. With experience, the market can look forward to lower costs and more reliable installations. It is also emphasized that funding in the way of seed money will allow installations to move forward so all parties can learn together including Ontario Hydro, the Ministry of Energy and the gas utilities. 4 refs., 6 tabs.

44567 (PB–90-872672/XAB) **Cogeneration: Economic and technical analysis. August 1983-June 1990 (A Bibliography from the NTIS data base). Report for August 1983-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 199p. Source: NTISPC N01/MF N01.

Supersedes PB–89-862189.

This bibliography contains citations concerning economic and technical analysis of cogeneration systems. Topics include electric power and steam generation, dual-purpose and fuel cell power plants, and on-site power generation. Tower focus power plants, solar cogeneration, biomass conversion, coal liquefaction and gasification, and refuse derived fuels are discussed. Feasibility studies, performance and economic evaluation, environmental impacts, and

institutional factors are included. (This updated bibliography contains 375 citations, 21 of which are new entries to the previous edition.)

44568 (PB–90-872748/XAB) **Graphite lubricants. December 1976-May 1990 (A Bibliography from the COMPENDEX data base). Report for December 1976-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 62p. Source: NTISPC N01/MF N01.

Supersedes PB–89-852560.

This bibliography contains citations concerning graphite particles used as a dry lubricant and as an additive for conventional lubricants. Effects on friction, wear performance, load bearing, contact area, and contact stress are among the topics discussed. Wear modelling, aging, particle structure, purity, and particle size relative to synthetic and natural graphites are included. Other dry lubricants such as molybdenum disulfide and mica are considered. (This updated bibliography contains 124 citations, 14 of which are new entries to the previous edition.)

44569 (PNL–7316) **Impact evaluation of an energy savings plan project at Lamb-Weston, Inc.** Spanner, G.E.; Wilfert, G.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 17p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract AC06-76RL01830. Order Number DE90015555. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This impact evaluation of an energy conservation measure (ECM) that was recently installed at Lamb-Weston, Inc. (Lamb-Weston) was conducted for the Bonneville Power Administration (Bonneville) as part of an evaluation of its Energy $avings Plan (E$P) Program. The Program awards cash incentives to firms that install energy conservation measures in their industrial processes. The objective of this impact evaluation was to assess how much electrical energy is being saved at Lamb-Weston as a result of the E$P and to determine how much the savings cost Bonneville and the region. The impact of the ECM was evaluated with a combination of engineering analysis, financial analysis, interviews, submittal reviews (Lamb-Weston's Completion Report, Proposal, and Abstract), and process evaluation reviews. The ECM itself consists of a heat recovery heat exchanger added to the hot drain of a potato blancher to reclaim heat that would otherwise be discarded at Lamb-Weston's Plant 1 in Quincy, Washington. At this facility, Lamb-Weston makes frozen French fried potatoes for institutional and consumer markets. Energy savings resulting from this ECM are expected to be 4,037,101 kWh per year. The ECM cost $67, 020 to install and Lamb-Weston received an incentive from Bonneville of $40, 212. The levelized cost of these energy savings to Bonneville will be 0.83 mills/kWh over the ECM's expected 15-year life, and the levelized cost to the region will be 1.50 mills/kWh.

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Refer also to citation(s) 43874, 43875, 43876, 43877, 43878, 43879, 43880, 43881, 44065, 44066, 44067, 44080, 44206, 44227, 44239, 44268, 44269, 44270, 44272, 44309, 44444, 44467, 44558, 44560, 45293, 45344

44570 (CONF-901036–1) **The fate of radionuclides in sewage sludge applied to land.** Boston, H.L. (Oak Ridge National Lab., TN (USA)); Van Miegroet, H.; Larsen, I.L.; Walzer, A.E.; Carlton, J.E. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. international conference on environmental contamination; Barcelona (Spain); 1-4 Oct 1990. Order Number DE90015159. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Municipal sewage sludge containing up to 12 pCi/g ^{137}Cs, 20 pCi/g ^{60}Co, and 300 ppm U was injected in a pasture (43 Mg/ha) and sprayed over a young pine plantation (34 Mg/ha). In the pasture, radionuclides were largely retained in the upper 15 cm of the soil, and only about 15% moved below 15 cm. Sludge rapidly infiltrated the soil on the pine plantation. One year after application, at least 85% of the ^{137}Cs, ^{60}Co, and U were found in the upper 7 cm of the pine plantation, with only about 15% moving into the 7- to 15-cm strata. On-site total added radiation dose was 2 to 6 mrem/year. Radionuclides were not detected above background in soil solutions at ~50 cm depth or in shallow down-gradient groundwater wells. Surface runoff from application areas did not have elevated radionuclide concentrations. Concentrations of these radionuclides increased slightly in vegetation on treated sites, and uranium was notably higher in earthworms. 9 refs., 2 tabs.

44571 (DOE/OR/21389–26) **Energy implications of alternative solid waste management systems: Final report.** White, A.L.; Becker, M.B.; Schatzki, S.T. Tellus Inst., Inc., Boston, MA (USA). Feb 1990. 100p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE90015073. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This study examines the energy implications of alternative solid waste management systems. As state and local governments move away from a traditional single facility strategies to more integrated waste management systems, energy use and recovery patterns will be substantially altered. The direct and indirect effects of such trends will result in major shifts in the volumes and composition of waste handled at incineration, recycling, composting and landfill facilities. In addition, second order energy savings will result from the substitution of recycled for virgin materials in the manufacturing sector. As such shifts occur, the energy balance – the difference between energy recovered and energy used – will undergo major adjustments. Such repercussions will occur at the regional, state, local and facility-specific level. Energy balances defined in this study cover seven use points, three recovery points and, separately, energy saved in production processes. For each of eleven Northeastern states, we estimate current balances based on existing waste management systems. State-specific profiles of recycling, composting, resource recovery and landfill activities provide the starting point for these base year estimates. Using the same estimating procedure, and taking into account each state's policy and planning objectives during the 1990's, we proceed to estimate the energy balances which will result if such objectives are met. By comparing current against future balances, we project the percentage change over a specified planning horizon. 2 figs., 37 tabs.

44572 (EGG-M–89481) **Utilization of waste tires employing novel surface-modification technology.** Bauman, B.D. (Air Products and Chemicals, Inc., Allentown, PA (USA)). EG and G Idaho, Inc., Idaho Falls, ID (USA); Air Products and Chemicals, Inc., Allentown, PA (USA). [1989]. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-88ID12695. (CONF-8912109–1: Scrap tire seminar, Philadelphia, PA (USA), 4 Dec 1989). Order Number DE90015472. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Air Products and Chemicals, Inc. is developing unique technology for the recycle of scrap tires. The approach involves surface-modification of ground tire rubber particles to facilitate their incorporation into novel composites. This form of recycling represents the highest value-added and greatest energy conservation potential of all tire recycle technologies. Furthermore, it is environmentally innocuous. Research and development of this unique technology is partially funded through a cost-shared contract with the US Department of Energy. 4 figs.

44573 (EPRI-CU–6886) **Rate design: Traditional and innovative approaches: Final report.** Chamberlin, J.H. (Barakat and Chamberlin, Inc., Oakland, CA (USA)). Electric Power Research Inst., Palo Alto, CA (USA); Barakat and Chamberlin, Inc., Oakland, CA (USA). ©Jul 1990. 224p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

This is a report on public and privately owned utility costing and rate design. It describes techniques for calculating time-varying marginal and accounting costs and for employing these costs in the development of rate structures and special incentive rates. Rate designs addressed include blocked and time-of-use, cost-based incentive, and cogeneration rates. The report presents procedures for evaluating alternative rate designs as strategic tools and discusses revenue adjustments and automatic adjustment clauses. A previous edition of this report was the text for an American Public Power Association (APPA) short course on innovative rate design; it relied on material from EPRI Electric Utility Rate Design Study (EURDS). 39 refs., 24 figs., 77 tabs.

44574 (EPRI-EL–6912) **Multi-area power system reliability and production costing: Final report.** Lee, F.N. (Oklahoma Univ., Norman, OK (USA). School of Electrical Engineering and Computer Science). Electric Power Research Inst., Palo Alto, CA (USA); Oklahoma Univ., Norman, OK (USA). School of Electrical Engineering and Computer Science. ©Aug 1990. 101p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

In the electric utility industry of the US utility systems are extensively interconnected. The interconnections provide abundant opportunities for sharing generation resources to enhance operational economics and operational reliability in an interconnected "multi-area" system. In the era of increased awareness of electricity cost, utility industry is actively seeking alternatives to reduce costs without jeopardizing service reliability. As a result, multi-area joint operation is receiving increased attention as a possible alternative. The objective of this research is to explore two methods which could be used for evaluating the production costs and reliability of multi-area power systems. The first method, a direct method, is described in Chapter II. The second method, an approximation method, is described in Chapters III and IV. In Chapters II, III, and IV, the transmission interconnection network is represented by the linear flow network model. In Chapter V, the demand-supply feasibility associated with a DC power flows network representation is discussed, and an approach is suggested for implementing this more accurate model in multi-area production costing and reliability evaluation.

44575 (EUR–11717) **Recovery of plastics waste.** Commission of the European Communities, Luxembourg (Luxembourg). 1988. 251p. (In FR, EN). Source: NTIS (US Sales Only), PC A12/MF A01.

This report gives an account of the proceedings of an international conference held in Paris in March 1988 on the recovery of plastic waste, and on the debate on its recycling - making of it rather than merely burning it or using it for landfill. There is something to be said for and against each of these solutions. Each has its own energy potential and environmental impact; and each can be profitably applied given the right technology. After an evaluation of the state of research into the problem, the delegates described the sources and disposal of reusable plastics in Japan, Italy, the United States and France, then described the collecting and sorting operations based on different English, Belgian and French examples, before concluding with the new applications for recycled plastics this time using Italian and French instances.

44576 (GAO/RCED–89-164) **Hazardous waste sites: State cleanup status and its implications for federal policy.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 96p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report has found that while most states have accomplished few or no cleanups of sites contaminated by hazardous waste, some have enacted tough cleanup laws, committed relatively large resources to the cleanup effort, and achieved considerable results. At the 17 cleanup sites analyzed, state cleanup plans were generally stringent. However, no federal standards have been set for over half of the contaminants found at these sites. For 11 sites, the states set cleanup levels without doing formal risk assessments. Also, most states reviewed did not consider the full range of alternatives EPA requires. Most states have not shown that they can effectively clean up large, hazardous waste sites. This report recommends that EPA turn sites targeted for cleanup over to the states only if there are adequate controls and oversight.

44577 (GAO/RCED–90-34) **Federal electric power Bonneville's residential exchange program.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Mar 1990. 46p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report states that the disparity in electric power rates paid by residential and small farm customers in the Northwest has decreased over the past decade. The $1.37 billion in exchange program benefits that Bonneville provided to Northwest utilities through fiscal year 1988 has contributed to this decrease. However, a more significant factor in reducing the rate disparity was the fact that Bonneville's costs - and, consequently, its power rates - increased significantly more than did those of the regional utilities. Bonneville has not been conducting the reviews needed to ensure that utilities are passing program benefits through to their residential and small farm customers, although the Northwest Power Act specifically directs Bonneville to do so. Given the dollar value of the benefits that have been provided to regional utilities, GAO believes Bonneville should do such reviews.

44578 (NYSERDA–90-7) **Buffalo district heating system design and construction: Final report.** Oliker, I. Burns and Roe, Inc., Oradell, NJ (USA). Nov 1987. 58p. Sponsored by New York State Energy Research and Development Authority. Source: OSTI; New York State Energy Research and Development, Two Rockefeller Plaza, Albany, NY 12223.

This report addresses the introduction of district heating in Buffalo, NY from feasibility study to implementation. The reemergence of district heating in the US and associated advantages are reviewed. Advanced piping technology which has enabled district heating to compete economically with alternative technologies is summarized. Identification and analysis of the customer heat load considered in downtown Buffalo for the pilot system and future expansion is discussed. Various options for initiating construction of a district heating system were considered as exemplified by the configuration for the pilot system which was selected to serve five downtown buildings. A conceptual plan is presented which permits the system to expand in an economically viable manner. The report concludes with an economic analysis which simulates the operation and expansion of the system. 4 figs., 8 tabs.

44579 (OME–90-01732, pp. 1-7, Paper 8) **TransCanada Pipelines Ltd.** Greflund, F. (TransCanada Pipelines Ltd., Toronto, ON (Canada)). Ontario Ministry of Energy, Toronto, ON (Canada). [1988]. (CONF-8803272–: Cogeneration: experience and prospects in Ontario, Mississauga (Canada), 10 Mar 1988; MICROLOG–90-01732). In *Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar.* Source: PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

TransCanada's Dual Power Project at Nipigon, Ontario is a modified combined cycle plant which produces both electric and gas compression power. The incremental power requirements in northwestern Ontario coupled with TransCanada's need to replace some of its aging fleet of gas turbine compressors formed a mutual benefit for both Ontario Hydro and TransCanada. Nipigon was chosen because the station is presently a bottleneck in the gas transmission system which is unable to meet the maximum discharge pressure of 7240 kilopascals; and the location is about 500 m from Ontario Hydro's 115 kV transmission system. The project offers the advantages of: reliable incremental power; availability in excess of 92%; capacity can be tailored to demand; existing Hydro transmission system is in place; environmentally benign; and a short lead time to construct. The plant will be interconnected with TransCanada's gas control center and will be dispatched as a base load unit. Net electric power and compression power are estimated to be 330 GWh/annum and 117 GWh/annum, respectively. It is expected that the project will be in service by mid-1990. 1 fig.

44580 (PB–90-215112/XAB) **Characterization of municipal solid waste in the United States: 1990 update.** Kaldjian, P. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response. Jun 1990. 130p. (EPA–530/SW-90/042). Source: NTIS, PC A07/MF A01.

See also PB–88-232780.

The report is the most recent in a series of reports released by the EPA to characterize Municipal Solid Waste (MSW) in the United States. It characterizes the national waste stream based on data through 1988 and includes: information on MSW generation from 1960 to 1988; recovery for recycling, composting, and combustion from 1960 to 1988; characterizing MSW by volume as well as by weight; projections for MSW generation to the year 2010; projections for MSW combustion through 2000; and projections (presented as a range) for recovery and recycling through 1995.

44581 (PB–90-228834/XAB) **Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 1. Summary of results. Final report, December 1987-May 1988.** Scheil, G.; Klamm, S.; Whitacre, M.; Surman, J.; Kelly, W. Midwest Research Inst., Kansas City, MO (USA). Jul 1989. 161p. Source: NTIS, PC A08/MF A01.

See also Volume 2, PB–90-228842; Also available in set of 3 reports PC E99/MF E99, PB–90-228826.

The report gives results of an emission test of a new municipal solid waste combustor, in Biddeford, ME, that burns refuse-derived fuel and is equipped with a lime spray dryer fabric filter (SD/FF) emission control system. Control efficiency of the SD/FF emission control system was measured for polychlorinated dibenzo-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), particulate matter (PM), cadmium (Cd), chromium (Cr), arsenic (As), lead (Pb), mercury (Hg), sulfur dioxide (SO_2), and hydrogen chloride (HCl). Additional continuous monitoring was conducted for oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NOx), and total hydrocarbons (THC).

44582 (PB–90-228842/XAB) **Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 2. Appendices A-F. Final report, December 1987-May 1988.** Schell, G.; Klamm, S.; Whitacre, M.; Surman, J.; Kelly, W. Midwest Research Inst., Kansas City, MO (USA). Jul 1989. 577p. Source: NTIS, PC A25/MF A04.

See also Volume 1, PB–90-228834 and Volume 3, PB–90-228859; Also available in set of 3 reports PC E99/MF E99, PB–90-228826.

Volume two contains the data collected by methods described in volume one (PB90-228834). Volume two contains numerical analyses, tables, graphs, and results.

44583 (PB–90-228859/XAB) **Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 3: Appendices G-N. Final report, December 1987-May 1988.** Schell, G.; Klamm, S.; Whitacre, M.; Surman, J.; Kelly, W. Midwest Research Inst., Kansas City, MO (USA). Jul 1989. 620p. Source: NTIS, PC A99/MF A04.

See also Volume 2, PB–90-228842; Also available in set of 3 reports PC E99/MF E99, PB–90-228826.

Volume three is a continuation of volume two (PB90-228842). Volume three contains results, numerical analysis, tables, and graphs.

44584 (PNL–7431) **Central Heating Plant site characterization report, Marine Corps Combat Development Command, Quantico, Virginia.** Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 115p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90015512. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report presents the methodology and results of a characterization of the operation and maintenance (O&M) environment at the US Marine Corps (USMC) Quantico, Virginia, Central Heating Plant (CHP). This characterization is part of a program intended to provide the O&M staff with a computerized artificial intelligence (AI) decision support system that will assist the plant staff in more efficient operation of their plant. 3 refs., 12 figs.

44585 Proceedings of the international symposium on energy options for the year 2000: Contemporary concepts in technology and policy. Volume 4. International cooperation. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. 4.166p. University of Delaware, Newark, DE (USA) (1988). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

This book contains the proceedings of the international symposium, Energy Options for the Year 2000, Volume 4, International Cooperation. Topics covered include: International cooperation in energy technology, Energy in developing countries 1-2, and Perspectives on energy policy.

44586 Competitive bidding for electric power: An analysis of the bid evaluation system of four utilities. Goldman, C. (Lawrence Berkeley Lab., CA (USA)); Kahn, E. pp. 111-121 of Energy markets in the 1990s and beyond. International Assoc. of Energy Economists, Washington, DC (USA) (1989). DOE Contract AC03-76SF00098. (CONF-8910162–: 11. annual North American conference of the International Association for Energy Economics (IAEE), Los Angeles, CA (USA), 16-18 Oct 1989).

This paper summarizes the study of the bidding systems used or proposed by several utilities. Focus is on systems which provide bidders with explicit self-scoring procedures because it facilitates comparison of the utility's treatment and valuing of non-price factors. The Utility verifies the bidders' information and selects winning projects based on the highest scores. The authors describe the bid evaluation systems and discuss the weights assigned to price and other factors. They illustrate the differences among the open bid evaluation systems by scoring the same set of eight bids in hypothetical auctions.

44587 The role of the energy engineer: Problem solving in the institutional sector. Rose, P.H. pp. 351-352 of Strategies for reducing natural gas, electric and oil costs. Association of Energy Engineers, Atlanta, GA (USA) (1990). (CONF-891028–: 12. world energy engineering congress, Atlanta, GA (USA), 24-28 Oct 1989).

This paper explains the role of the energy engineer in implementing energy management in institutions such as schools and hospitals. The author suggests that the engineer has a responsibility to make users and decision makers aware of their choices and the impact of their decisions in the larger context.

44588 District heating and cooling: Solution for year 2000. Kunjeer, P.B. (U.S. Dept of Energy, Office of Buildings and Community Systems (US)). pp. 1.109-1.114 of Proceedings of the international symposium on energy options for the year 2000: Volume 1. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1989). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

This paper discusses the attributes of district heating and cooling (DHC). Benefits of DHC are described for both present and future use.

44589 Alternative energy assistance strategies for Ohio. Hexter, K.W. (The Urban Center, Cleveland State Univ., Cleveland, OH (US)). pp. 1.27-1.32 of Proceedings of the international symposium on energy options for the year 2000: Volume 1. Heinonen, J.; Kainlauri, E.; Byrne, J.; Rich, D.; Salminen, M.; Seppanen, O. University of Delaware, Newark, DE (USA) (1989). (CONF-880920–: International symposium on energy options for the year 2000: contemporary concepts in technology and policy, Wilmington, DE (USA), 14-17 Sep 1988).

This paper addresses the problems presented by high energy costs as they affect poor people. According to the author, the challenge for the states is to develop a more national approach to delivering energy assistance services and allocating increasingly scarce financial resources. The Ohio Public Utilities Commission developed a study using a systems approach. The scope of the study, its findings, and its implications for future state energy assistance programs and policies are described.

44590 Local governments take on hazardous waste collection. Spencer, R.L. *BioCycle (USA)*, 30(3): 42-43 (Mar 1989).

Diversion of toxic chemicals from solid waste disposal facilities is one major reason communities conduct collection programs for Household Hazardous Wastes (HHW). By keeping wastes like old cans of paint thinner, pesticides, waste oil and car batteries, out of the trash collection, the hypothesis is that leachate, air emissions and compost quality will be improved. While special HHW collection days are the most common technique used by local communities, there are varied perspectives and issues about the effort which include; low average participation rates, high cost of collection, liability of sponsoring communities, and environmental benefits from diverting a small portion of waste from the solid waste facility. The major benefits are clearly educational. As community recycling programs and material reclamation facilities

develop, the public is becoming increasingly aware of the presence of HHW in their waste stream. This is a natural spinoff of source separation. The increased interest in solid waste composting facilities is also forcing communities to evaluate ways of producing compost with acceptable levels of contaminants.

33 ADVANCED PROPULSION SYSTEMS

Refer also to citation(s) 44534

3301 Internal Combustion Engines

Refer also to citation(s) 43676, 44599, 44705

44591 (AD-A–220956/7/XAB) **Effects of auxiliary injection on diesel-engine combustion.** Shakal, J.; Martin, J.K. Wisconsin Univ., Madison, WI (USA). Engine Research Center. 1990. 13p. Source: NTIS, PC A03/MF A01.

Pub. in SAE Technical Paper Series, No. 900398, 10(1990).

Pilot injection and two other forms of auxiliary fuel introduction have been studied for their effects on diesel engine combustion and emissions. A two-stroke diesel has been equipped with an electronic solenoid-controlled unit injector can operate with pilot injection. In addition, the engine has been fitted with experimental air-blast atomizing injectors in the inlet port and intake manifold. In-cylinder pressure, Bosch smoke, exhaust hydrocarbons, NO and NOx emissions have been made for a range of engine conditions. In addition, two fuels have been tested to observe the effects of fuel blend on the auxiliary fuel behavior.

44592 (AD-A–220988/0/XAB) **Processing of advanced ceramics which have potential for use in gas-turbine aero engines. Aeronautical note.** Maccagno, T.M. National Aeronautical Establishment, Ottawa, ON (Canada). Feb 1989. 5p. (NAE-AN–58). Source: NTIS, PC A01/MF A01.

Si3N4 and SiC based advanced ceramics that have been produced by hot isostatic pressing (HIPing) have good potential to be used as hot section components in gas turbine aero engines. This report provides background for an NAE-SML investigation of this potential. The report begins with a general overview of the many fabrication methods that have been used to produce both monolithic ceramics and SiC whisker reinforced composite ceramics. This is followed by a comprehensive survey of past efforts to produce Si_3N_4 and SiC based ceramics by HIPing. It is apparent that many of these efforts have involved HIPing of material that has already been densified by sintering, but such an approach does not really allow the full benefits of HIP processing to be realized. On the other hand, HIPing of Si_3N_4 based composite produced by reaction bonding may result in ceramic material of superior quality.

44593 (AD-A–220992/2/XAB) **Two-stroke diesel-engine simulation program.** VanGerpen, J.H. Battelle Columbus Labs., OH (USA). Feb 1990. 25p. Source: NTIS, PC A03/MF A01.

A computer program simulating a two-stroke diesel engine is developed and documented. The program is suitable for simulating the diesel core of a high-output combined-cycle diesel engine. The engine cylinder and the intake and exhaust ports are defined as independent thermodynamic systems and the mass energy equations for these systems are developed. A single zone combustion model is used and perfect mixing during scavenging is assumed. The program input requirements and output results are discussed. A sample case is provided for an opposed piston, uniflow scavenged two-stroke diesel engine. The mathematical model considers the thermodynamics and fluid mechanics of the working fluid from the entrance of the intake port to the exit of the exhaust port. The program can predict the effect on engine performance of changes in parameters such as speed, boost pressure, valve timing, and fueling level. The program output provides information about power output, brake mean effective pressure (BMEP), heat transfer losses, and cylinder pressures and temperatures. The program was written in modular form so that the submodels could be modified or replaced without requiring program alteration. This report discusses the mathematical model used in the program and describes the subroutines that make up the model. Input requirements are stated and the output listing is explained. A sample program run is also provided.

44594 (AD-A–221321/3/XAB) **Crc low- and intermediate-temperature driveability program using gasoline- alcohol blends.** Coordinating Research Council, Inc., Atlanta, GA (USA). Feb 1990. 195p. (CRC–568). Source: NTIS, PC A09/MF A02.

Original contains color plates: All DTIC reproductions will be in black and white.

A cooperative test program was conducted in 1986 and 1987 to characterize the relationship between cold-start and warmup driveability and gasoline volatility parameters of T10, T50, and T90 distillation temperatures. Hydrocarbon-only and gasoline-alcohol blends were tested. The test program was divided into two phases: the intermediate-temperature (40 F to 60 F) phase was conducted in Paso Robles, California, from October 13 through November 14, 1986; and the low-temperature (10 F to 40 F) phase was conducted in Brainerd, Minnesota, from January 19 through February 18, 1987. Driveability was better with high volatility fuels, and at intermediate ambient temperatures. Fuel-injected vehicles exhibited better driveability than carbureted vehicles. Driveability with hydrocarbon-only gasolines with significantly better than gasoline-ethanol blends, and gasoline-methanol:TBA blends. Compared with gasoline-methanol:TBA blends gasoline-ethanol blends gave significantly better driveability. Regression equations which related volatility to vehicle cold-start and warmup driveability were developed for both temperature phases.

3303 Electric-Powered Systems

44595 (CCOE–CE03114, pp. 33.0-33.18) **Electric vehicles: The adventure has begun.** O'Connell, L.G. (Electric Power Research Inst., Palo Alto, CA (USA)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

Widespread use of electric vehicles will help solve the air quality problems of many urban areas and will ease dependence on petroleum. In addition, electric vehicles offer benefits to utilities; since each electric vehicle consumes about the same amount of electricity as one residential customer, and most of the power needed for these vehicles could be generated during off-peak hours, many utilities could gain substantial new revenues without investing in new generating capacity. The process of commercialization of electric vehicles has initially concentrated on the commercial fleet market. The first of these vehicles is expected to come into production in July 1990. This vehicle is called the G-Van, powered by lead-acid batteries, and capable of performing either as a 1550-pound payload cargo van or as a 5-passenger vehicle. The van's performance characteristics (60-mile range between recharges and 52 mph top speed) allow it to accomplish tasks assigned to nearly 40% of the vans in large commercial fleets. Work is also proceeding on the development of the TEVan, a minivan powered by nickel-iron batteries with a 120-mile range and 70 mph top speed. Some future developments in electric vehicles are presented, including improved high-performance batteries, extended range vehicles, and ac power trains. Challenges to full commercialization include cost, infrastructure requirements, and extending the market for these vehicles. 7 refs., 6 figs., 4 tabs. proceeding toward

44596 **Comparative evaluation of acoustical noise levels of Soleq Escort EV and ICE counterpart.** MacDowall, R.D. (Idaho National Engineering Lab., Idaho Falls, ID (USA)). pp. 23-26 of Electric vehicle technology. Society of Automotive Engineers, Warrendale, PA (USA) (1990). DOE Contract AC07-76ID01570. (CONF-9002115–: Society of Automotive Engineers international congress and exhibition, Detroit, MI (USA), 26 Feb - 2 mar 1990).

Technical Paper 900138.

This paper describes a study which compares the exterior and interior acoustic noise levels of an electric vehicle to its internal

combustion engine (ICE) counterpart base vehicle, under various operating conditions. The electric vehicle was a converted 1988 Ford Escort station wagon, retrofitted with a DC electric power train. A comparably-equipped gasoline-fueled ICE-powered Ford Escort station wagon provided the baseline acoustic noise levels with which to compare the electric vehicle. Measurements of the interior and exterior noise levels were obtained using a modular precision sound level meter. The results indicate that radiated interior and exterior acoustic noise levels of the electric vehicle were noticeably quieter under acceleration and idle conditions. However, under constant speed operation the electric and the ICE exhibited essentially equivalent interior and exterior noise levels.

44597 On-road test and evaluation of the GM Griffon electric van. Tripp, M.W. (Detroit Edison Co., MI (USA)). pp. 11-22 of Electric vehicle technology. Society of Automotive Engineers, Warrendale, PA (USA) (1990). (CONF-9002115–: Society of Automotive Engineers international congress and exhibition, Detroit, MI (USA), 26 Feb - 2 mar 1990).

Technical Paper 900137.

This paper reports on a multi-year over-the-road evaluation of the General Motors Griffon electric van as part of the U.S. Department of Energy Electric Vehicle Site Operations Program. This paper describes the results obtained during the period from December 1984 through June 1989. Overall vehicle and battery performance is discussed in terms of driver acceptance, acceleration, range, energy consumption and maintenance requirements.

44598 Flow-by lead-acid: Improving the performance standard for EV battery systems. Budney, P.A. (Johnson Controls, Inc., Advanced Battery Business Unit, Milwaukee, WI (US)); Andrew, M.G. pp. 1-6 of Electric vehicle technology. Society of Automotive Engineers, Warrendale, PA (USA) (1990). (CONF-9002115–: Society of Automotive Engineers international congress and exhibition, Detroit, MI (USA), 26 Feb - 2 mar 1990).

Technical Paper 900135.

This paper reports on a project sponsored by the United States Department of Energy (DOE) for the design and development of an advanced lead-acid battery system for electric delivery vehicles. Significant improvements in specific energy on a cell basis during the last year nave positioned this technology within 6% of the goal of 56 Wh/kg. Currently, the majority of engineering efforts are directed towards improving the cycle life of this high performance battery. This goal is proving to be the most challenging due to the transient power nature of the SFUDS testing profile which provides a more accurate simulation of an EV duty cycle than the previously utilized constant current test regime. These efforts will culminate in the fabrication of a 180 volt, 39 kWh battery system which satisfies the performance, life, and cost goals for safe and efficient electric van propulsion.

3307 Emission Control

Refer also to citation(s) 43839

44599 (ORNL/Sub–86-SB195/1) **Heavy duty liquid and gaseous fuel emissions database test results from four alternative fuel configurations of the Caterpillar 3406 engine.** Waldman, D.J. (Caterpillar, Inc., Peoria, IL (USA)). Oak Ridge National Lab., TN (USA); Caterpillar, Inc., Peoria, IL (USA). Jun 1990. 68p. Sponsored by U.S. DOE Conservation & Renewable Energy; Gas Research Institute. DOE Contract AC05-84OR21400. Order Number DE90014783. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Through the cooperation of several organizations including the Oak Ridge National Laboratory (ORNL) acting under the auspices of the Doe Alternative Fuels Utilization Program, heavy duty transient and steady-state emissions tests were conducted on four alternative fuel configurations of the Caterpillar 3406 engine. These included a diesel baseline, glow plug ignited methanol (diesel cycle), lean-burn spark ignited natural gas, and dual fuel (diesel pilot ignited natural gas). Results indicated methanol and natural gas both show excellent potential for low NOx and low particulate emissions. With these fuels however, unburned fuel emissions were much higher, especially in the dual fuel case, than the diesel baseline. Particulate emissions from the methanol and lean burn gas engines are thought to be almost entirely lube oil sourced. All of the configurations will require significant reduction in hydrocarbon and/or particulate emissions in order to meet the 1994 EPA emissions standards for heavy duty truck engines. 3 refs., 23 figs., 15 tabs.

3308 Alternative Fuels

Refer also to citation(s) 43676, 44594, 44599

44600 (AD-A–221541/6/XAB) **In-flight evaluations of turbine fuel extenders. Final report.** Ferrara, A.M. Federal Aviation Administration, Atlantic City, NJ (USA). Technical Center. Feb 1990. 37p. Source: NTIS, PC A03/MF A01.

Flight tests were conducted which evaluated the use of ethanol as a blending agent for turbine fuels. As part of this study, a Beech King Air 200 was modified to incorporate a cabin tank which contained ethanol, and the fuel system was modified to deliver the ethanol to the starboard engine. Ten percent ethanol was mixed with JP-4 in the project fuel line, just before entering the engine. The test was performed over a broad range of operating conditions, and key performance parameters were measured. The use of ethanol as a blending agent reduced the power available and resulted in an increase in fuel consumption. The increase in fuel consumption was greater than the decrease in energy density. When operating on the ethanol/JP-4 mixtures, the test pilots noted the test engine required more throttle (throttle stagger). Ethanol, Turbine engines, Alternate fuels, Flight tests.

44601 (DOE/PE–90014954) **Impacts on home heating costs of incentives for alternative fuels vehicles.** USDOE Assistant Secretary for Policy, Planning and Analysis, Washington, DC (USA). Office of Policy Integration. Nov 1989. 33p. Sponsored by U.S. DOE Management & Administration. Order Number DE90014954. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Alternative Motor Fuels Act of 1988 offers incentives in the form of fuel economy credits to manufacturers who produce capable of using natural gas or alcohol fuels. Substitution of these fuels for gasoline in the transportation sector is likely to affect the prices of natural gas and disulfate oil, important sources of energy for home heating. The Act calls for a study to determine whether including alternative fuel credits in calculating corporate average fuel economy is likely to increase the average price of home heating to residential consumers. This report presents an analysis of that question. Assuming that manufacturers take full advantage of the alternative fuel credits available by building compressed natural gas (CNG) or methanol compatible vehicles, projections through the year 2013 are developed for the addition demand for natural gas and reduced demand for gasoline. It is assumed that all natural gas comes from domestic sources and that all methanol for transportation is imported. 11 refs., 7 tabs.

44602 (PB–90-225806/XAB) **Analysis of the economic and environmental effects of methanol as an automotive fuel. Special report.** Environmental Protection Agency, Ann Arbor, MI (USA). Office of Mobile Sources. Sep 1989. 88p. Source: NTIS, PC A05/MF A01.

In July 1989 the President submitted to Congress his Administration's proposals for revising the Clean Air Act. One major component of his plan is the Clean Alternative Fuels Program. The program would replace a portion of the motor vehicle fleet in certain cities with new vehicles that meet stringent air emission limits operating on clean burning fuels such as methanol, ethanol, compressed natural gas, liquified petroleum gas, electricity, and reformulated gasoline. The report, released by EPA, is the first in a series of reports that will discuss the economic and environmental issues associated with each of these fuels.

44603 (PB–90-225830/XAB) **Analysis of the economic and environmental effects of compressed natural gas as a vehicle fuel. Volume 2. Heavy-duty vehicles. Special report.** Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div. Apr 1990. 124p. Source: NTIS, PC A06/MF A01.

See also Volume 1, PB–90-220559.

In July 1989 the President submitted to Congress his Administration's proposals for revising the Clean Air Act. One major component of his plan is the Clean Alternative Fuels Program. The program would replace a portion of the motor vehicle fleet in certain cities with new vehicles that meet stringent air emission limits operating on clean burning fuels such as methanol, ethanol, compressed natural gas, liquified petroleum gas, electricity, and reformulate gasoline. The report, released by EPA, is the third in a series of reports that will discuss the economic and environmental issues associated with each of these fuels.

35 ARMS CONTROL

44604 (AD-A-221221/5/XAB) **Soviet measurements of strategic balance and arms control. Sanitized. Technical report, 1 April 1984-30 September 1985.** Grange, J.K.; Battilega, J.; Bennett, S.; Summers, M. Science Applications International Corp., Greenwood Village, CO (USA). 21 Apr 1986. 51p. (SAIC-86/6054-SAN). Source: NTIS, PC A04/MF A01.

This sanitized report concludes that, although the requirements and concerns of the Soviet military are not the only factors that influence the positions that the Soviet arms control negotiators offer, it is unlikely that the Soviet Union will agree to arms control provisions that measurably reduce the ability of the military forces of the Soviet Union to fulfill the requirements for military capability that are formally levied through military doctrine. Topics include: Elements of the Soviet view of the strategic balance – The Soviet framework for assessing military adequacy, Strategic missions of the Soviet armed forces, Measurements of the correlation of forces, and Assessment of mission adequacy; Some implications of the Soviet assessment methods for arms control – Limiting the rate of change of the threat, Prevent introduction of new kinds of systems, Maintain freedom to determine mix of delivery systems, Strive to define the framework for the negotiations consistent with the Soviet planning framework, Try to get and increase in the warning of enemy actions, and Minimize the intrusiveness of verification methods; Some major changes in the threat that impact Soviet assessments – The principal changes since 1982, Pershing II and GLCM deployments, Long-range ALCM, ICBM modernization, and The Militarization of Space.

44605 (AD-A-221716/4/XAB) **Disarmament: The role of conventional arms control in national security strategy. Final report.** Hallenbeck, R.A.; Shaver, D.E. Army War Coll., Carlisle Barracks, PA (USA). Strategic Studies Inst. 1 Mar 1990. 235p. Source: NTIS, PC A11/MF A02.

Disarmament, Conventional Arms Control, Negotiations on Conventional Armed Forces in Europe (CFE), Confidence- and Security-Building Measures (CSBM), Conference on Security and Cooperation in Europe (CSCE), Armored Combat Vehicles, tanks, artillery, combat aviation, personnel ceilings, sub-zones, NATO, Warsaw pact, Neutral and nonaligned. In this textbook the authors address significant conventional arms control history; development of U.S. and NATO objectives for the talks; pertinent issues which had to be resolved; the role of partial disarmament in National Security Strategy; and conclude with a full discussion of CFE and CSBM proposals, data, and the military implications of a successful agreement. The authors provide answers to the important questions: How close are we to an agreement. Can conventional arms reductions be verified. What does the post arms reduction world look like. What is the future of the alliances in Europe. Will we have to change national security strategy. Is arms control still relevant, considering the changes in Eastern Europe. How can we agree on answers before events change them. This book is somewhat unique since it incorporates the work of practitioners, academics, and actual members of our U.S. conventional arms control negotiating teams.

3501 Policy, Negotiations, and Legislation

44606 (INIS-XN-212) **Royal order relating to the transfer of nuclear materials and technology to non-nuclear weapon states.** Belgium. May 1989. 9p. (In French, Dutch). Order Number DE90627084. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

In implementation of the Act of 1981 on conditions for the export of nuclear materials, equipment and technological data, this Order sets down the detailed mechanisms for such transfers. Its object is to ensure that they will be carried out exclusively for peaceful purposes and in conformity with the NPT.

3503 Verification

44607 (AD-A-221226/4/XAB) **Assessment of the utility of on-site inspection for INF treaty verification. Sanitized. Technical report.** Baker, J.C.; Hart, D.M.; Doherty, R.T. Pacific-Sierra Research Corp., Arlington, VA (USA). Washington Operations. 10 Nov 1983. 90p. Source: NTIS, PC A05/MF A01.

Sanitized version of AD-C955 944L.

This report analyzes the utility of on-site inspection (OSI) for enhancing Intermediate-Range Nuclear Force (INF) treaty verification of Soviet compliance with US-proposed collateral limits on short-range ballistic missiles (SRBMs). It outlines a detailed verification regime that relies on manned OSI teams to help verify limitations on Soviet SRBM deployments. It also assesses the OSI regime's potential impact on US Pershing deployments. Finally, the report reviews the history of American policy concerning on-site inspection and evaluates the overall utility of OSI in support of National Technical Means.

44608 (AD-A-221493/0/XAB) **Regional seismic event location with a sparse network: Application to eastern Kazakhstan, USSR.** Thurber, C.; Given, H.; Berger, J. State Univ. of New York, Stony Brook, NY (USA). Dept. of Earth and Space Sciences. 10 Dec 1989. 15p. Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 94, No. B12, 17,767-17,780(10 Dec 1989).

Three-component data from a sparse three-station seismic network in eastern Kazakhstan, surrounding the Soviet nuclear test site, were analyzed to determine location estimates for regional events recorded by two or three stations. Included among these events are the Sept. 1987 chemical explosions whose locations are known. Locations are calculated using arrival times of P and S phases and arrival azimuths from first P. Location uncertainties are estimated using a combination of a priori and a posteriori data uncertainties. A layered P wave velocity model adapted from Soviet Deep Seismic Sounding surveys is used for calculating travel times, and two S models are tried. Location results for the chemical explosions are excellent, even if only two stations are used: absolute location errors are less than 10 km, and estimated 90% confidence uncertainties are only a few kilometers. The data are also adequate to determine correctly their depth (i.e., focus at the surface). The other regional events include numerous suspected mine blasts and two earthquakes from the Tien Shan. The calculated locations of the latter events agree well with a teleseismic location for one of them, falling within a belt of regular seismic activity. Nearly all of the presumed blasts can be associated with mapped mines, and we have been able to identify the source areas for two sets of blasts in high-resolution satellite images.

44609 (AD-A-221768/5/XAB) **Seismic surveillance. Nuclear test ban verification. Report for 1 January-31 December 1989.** Husebye, E.S.; Ruud, B.O. Oslo Univ. (Norway). Dept. of Geology. 26 Feb 1990. 139p. (SCIENTIFIC-1). Source: NTIS, PC A07/MF A01.

The research can be divided into three main topics: (i) robust seismic event location schemes; (ii) crustal structure mapping; and (iii) teleseismic P-coda scattering analysis. New techniques are presented for fast and robust event location. In case of available arrival times from a network of seismograph network (aperture up to 10- 15 deg) a variant of Geiger's method for fitting arrival times to travel time tables, gave average location errors less than 1 deg in the teleseismic distance range. In another study, the location schemes are tied to the slowness vector as easily derived from arrays and 3-component stations, namely azimuth error minimization and slowness vector summation on a sphere for N arbitrary positioned stations. Crustal structures are managed for various parts of Fennoscandia where the 3 seismic arrays NORESS, ARCESS and

FINESA are sited. NORESS P-wave coda of 75 s duration from 8 teleseismic events of widely different azimuths have been examined using both array and 3C analysis techniques. Although source-end scattering could not be separated from the source pulse per se, favor the hypothesis of long source duration is supported by observed slow beam amplitude decay rates. The majority of receiver-end scattering contributions appears to be P-to-Rg conversions in both forward and backward modes from two nearby areas with pronounced/topographic reliefs.

44610 (AD-A-221820/4/XAB) **Rock strength under confined shock conditions.** Scholz, C.H. S-Cubed, San Diego, CA (USA). Oct 1982. 53p. (SSS-R-83-5906). Source: NTIS, PC A04/MF A01.

This report addresses the laboratory measurements of the static strength of rock needed to simulate the response of rock to an underground explosion. The approach is to identify the variables that affect the strength of rock and to discuss each effect in terms of the underlying processes that cause it. Most of the report is the result of a literature review, although some new analyses and concepts are presented. Attention is directed at three basic rock types: low porosity brittle rock such as granodiorite, high porosity brittle rock such as volcanic tuff, and a rock that may be ductile under the relevant conditions, salt. These three rock types are sufficiently different that somewhat different constitutive laws may have to be used to model their behavior.

36 MATERIALS

44611 Information systems design for materials properties data. McCarthy, J.L. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). pp. 135-150 of Computerization and networking of materials data bases. Glazman, J.S.; Rumble, J.R. Jr. ASTM, Philadelphia, PA (USA) (1989). DOE Contract AC03-76SF00098. (CONF-8711337--: 1. international symposium on computerization and networking of materials data bases, Philadelphia, PA (USA), 2-4 Nov 1987).

Material properties data present numerous challenges. Major problems include data complexity, naming conventions, measurement units, summary levels of abstraction, and data sparseness. Networks and gateways to multiple material information systems compound these challenges and add others. Experience from projects such as the materials information for science and technology (MIST) system prototype suggests several general approaches that address these problems, including modular system architecture; a three-tiered approach to naming materials, properties, and variables; an active data thesaurus; material and variable class hierarchies; structured representation of tables and graphs; and existence tables to indicate data availability by the cross product of materials, properties, and independent variables for any given data base. It also suggests the need to go beyond the simple relational model to solve problems and implement solutions.

3601 Metals and Alloys

Refer also to citation(s) 43661, 43662, 43663, 43687, 43688, 43760, 43761, 44001, 44131, 44193, 44216, 44219, 44220, 44225, 44234, 44242, 44246, 44252, 44283, 44284, 44286, 44362, 44526, 44691, 44795, 44798, 44814, 44858, 44866, 44875, 44992, 45023, 45026, 45156, 45218, 45918, 46043, 46129, 46130, 46131, 46227, 46228, 46229, 46230, 46231, 46232, 46233, 46234, 46235, 46236, 46237, 46238, 46246, 46286

44612 (AD-A-221172/0/XAB) **Hydrogen adsorption on the beta-N-covered W(100) surface: An infrared study of the W-H stretch.** Riffe, D.M.; Sievers, A.H. Cornell Univ., Ithaca, NY (USA). 15 Feb 1990. 21p. Source: NTIS, PC A03/MF A01.

Pub. in Physical Review B, Vol. 41, No. 6, 3406-3425(15 Feb 1990).

The adsorption of hydrogen on the c(2X2)Beta-N-covered Tungsten(100) surface has been studied with infrared and thermal-desorption spectroscopies. A new dipole-active vibrational absorption due to chemisorbed hydrogen has been discovered. Its center frequency (1738/cm for minimal H2 and adsorption), isotopic dependence (1252/cm) for Deuterium adsorption and the existence of both lines for HD adsorption, absorption strength versus beta-N coverage, and effective dynamic charge lead to the assignment of the W-H stretch associated with a top-bonded H species. The vibration has been studied in detail on the highly ordered surface characterized by a beta-N coverage of 0.5 monolayer: In the zero-coverage limit vibrational decay due to electron-hole pair excitations may provide the dominant contribution to the full width at half maximum of 12/cm. Away from this limit inhomogeneous broadening, caused by coadsorption of molecular and other atomic species, appears to increasingly contribute to the width, which attains a maximum of 35 cm at saturation. Isotopic dilution and H-coverage experiments reveal a dynamical shift of +14/cm in going from the isolated adatom to full layer limit which is explained by a combination of direct dipole-dipole and indirect electron-mediated interactions. With increasing coverage two chemical shifts have also been discerned: a positive one (+21/cm) attributed to electron-density competition among the adsorbed atomic species and a negative one (-17/cm) due to molecular-species coadsorption.

44613 (AD-A-221463/3/XAB) **Algorithms to solve nonlinear time-dependent problems of engineering and physics. Final report, 1 August 1986-31 May 1989.** Case, J.; Widder, E.; Cook, D. California Univ., Los Angeles, CA (USA). Dept. of Mathematics. 30 Jun 1989. 5p. Source: NTIS, PC A01/MF A01.

During this last year Osher developed a joint project with James Sethian concerning fronts propagating with curvature dependent speed. They devised new algorithms approximating the equations of motion, which resemble Hamilton-Jacobi equations with parabolic right-hand sides, by using techniques from hyperbolic conservation laws. Essentially non-oscillatory schemes are used. These methods accurately capture the formation of sharp gradients and cusps in the moving fronts. The algorithms handle topological merging and breaking naturally, and work in any number of space dimensions. The methods can also be used for more general Hamilton-Jacobi type problems. Applications of the algorithms include crystal growth, solidification of metals and flame propagation.

44614 (AD-A-221776/8/XAB) **Advanced processing and properties of high-performance alloys. Technical report No. 16, 1 January-31 December 1989.** Koss, D.A. Pennsylvania State Univ., University Park, PA (USA). Dept. of Materials Science and Engineering. Apr 1990. 24p. Source: NTIS, PC A03/MF A01.

Progress is reviewed for a research program whose purpose is to establish a broad-based understanding of the application and consequences of advanced processing techniques, especially as they influence the strength and fracture resistance of high performance structural alloys. While some of the research is specific to certain alloy systems, much of the program constitutes fundamental study of the deformation and fracture of engineering alloys containing processing induced defects. Progress is reviewed for the following projects within the program: modeling the effects of pores or voids on fracture, the processing and properties of Cu-Nb alloy, and a new age-hardenable beta titanium system. Metallurgy, Copper, Niobium, Alloys, Strength (Mechanics), Mechanical properties, Fracture (Mechanics), Materials.

44615 (AERE-R-13768) **Heat capacity of protactinium metal and three plutonium compounds at low temperatures: Final report.** Hall, R.O.A. (UKAEA Harwell Lab. (UK). Chemistry Div.); Mortimer, M.J.; Spirlet, J.-C. UKAEA Harwell Lab. (UK). Chemistry Div. Mar 1990. 10p. Source: Available from H.M. Stationery Office, London, price Pound 8.00.

A series of high purity, single crystal, plutonium monopnictides and chalcogenides were prepared at JRC Karlsruhe and subsequently the heat capacity of some of these were measured at Harwell. This report summarises the results, together with data on protactinium metal prepared at JRC by the van Arkle (iodide process) technique. (author).

44616 (BNL-44939) **Recent progress in electronic structure calculations for defects in metals.** Zeller, R. (Forschungszentrum Juelich GmbH (Germany, F.R.). Inst. fuer Festkoerperforschung); Drittler, B.; Dederichs, P.H.; Klemradt, U.; Weinert, M. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900883-1: International conference and

exhibition on computer applications to materials science and engineering: computer-aided innovation of new materials, Tokyo (Japan), 28-31 Aug 1990). Order Number DE90016323. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe recent progress in first-principles calculations of total electronic energies for vacancies and impurities in metals. The calculations are based on density-functional theory in the local-spin-density approximation and on full-potential multiple-scattering theory. We present results for vacancy formation, impurity solution and interaction energies which agree well with available experimental data. 13 refs., 3 figs.

44617 (CEGB-RD-M–1712/RR88) **Weld simulated US Mod 9Cr1Mo steel: Pt. 2: Softening phenomenon at the base metal - heat affected zone interface.** Ferranti, M. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Jan 1989. 17p. Order Number DE90636544. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Weld simulated samples of US Mod 9Cr1Mo were examined by a combination of metallographic techniques such as transmission electron microscopy on carbon replicas, optical microscopy and computer image analysis. The object was to determine the causes of the hardness drop associated with the interface between the base metal and the heat affect zone (HAZ) and its precise position with respect to the weld thermal cycle. The results show that softening occurs by overtempering of the narrow region of the base metal immediately adjacent to the HAZ as a result of a weld thermal cycle characterised by a peak temperature approximately equal to the Ac_1 temperature. Post weld heat treatment (PWHT) increases the soft zone width which then encompasses the partially transformed material. It has also been found that overtempering is associated with an Ostwald Ripening type of growth of the M(C,N) precipitates under the influence of both weld thermal cycle and PWHT. By contrast, the dimension of the $M_{23}C_6$ particles are not affected by the above thermal cycles. Finally, the effect of heat input on the magnitude of the hardness drop was investigated. The hardness decrease is a minimum for either very high or very low heat inputs, increasing to its maximum value for 10,000 J/mm. These results were tentatively interpreted in terms of a combination of coarsening and concurrent nucleation of M(C,N) precipitates. (author).

44618 (CEGB-TD-B–6305/R89) **The influence of elevated temperature transformation and mechanical properties of a precipitation hardening martensitic stainless steel on its wear behaviour.** Smith, A.F. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Nov 1989. 36p. Order Number DE90636566. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Self wear tests of a martensitic stainless steel in CO_2 in the temperature range 20-300degC showed transitional behaviour at 20 and 300degC. In the mid temperature range a severe wear rate of $\approx 2 \times 10^{-13}$ m^3/Nm persisted for sliding distances up to 2000 m. A possible explanation was that while strain induced transformation of retained austenite at low temperatures provided a sufficiently hardened substrate that allowed inelastic rather than plastic interactions this did not occur at 200degC. Tests were carried out to determine the temperature above which strain no longer transformed austenite into martensite. Although a martensite start temperature of $\approx$ 150degC was found for the present steel the presence of only $\approx$ 10% retained austenite in the "as heat treated" material suggests that its transformation to martensite at 200degC would not materially affect the extent of subsurface hardening. It is proposed that a surface reaction plays a role in transition behaviour. At 300degC the reaction product is an oxide but at room temperature it is possibly a carbonate. The stability of the carbonate decreases with temperature thus giving an intermediate temperature range where metal/metal contacts prevail leading to the persistent high wear behaviour. (author).

44619 (CONF-900466–80) **Alloy design of ordered intermetallics.** George, E.P.; Liu, C.T. Oak Ridge National Lab., TN (USA). [1990]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990. Order Number DE90016031. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ordered intermetallics based on aluminides and silicides constitute a unique class of metallic materials promising high-temperature properties. However, brittle fracture and poor ductility limited their use as engineering materials in most cases. During the past ten years extensive research has been conducted on ordered intermetallics. As a result, significant progress has been made in identifying various causes of brittle fracture, and their relative importance in different ordered alloys. In some cases this understanding has helped achieve dramatic improvements in ductility. We review here three different classes of brittle fracture in ordered intermetallics and discuss the results in terms of model alloy systems chosen from each class. Ni_3Al and NiAl are discussed as prototypical ordered alloys prone to intrinsic intergranular brittleness. They are used to review our current understanding of intrinsically weak grain boundaries and the mechanisms by which boron is thought to suppress intergranular fracture. Next, FeAl and Fe_3Al are discussed as examples of ordered intermetallics that are susceptible to environmental embrittlement at ambient temperature. Recent discoveries in these two alloy systems are reviewed with special emphasis on some of the rather interesting but subtle effects of test environment. Finally, Al_3X type intermetallic (Al_3Sc,Al_3Ti-base, and Al_3Zr-base alloys) are discussed as examples of ordered alloys that have high symmetry ($L1_2$ structure), are relatively soft, yet cleave transgranularly with very little ductility. In all these cases, experimental results are compared with theoretical calculations. 125 refs., 8 figs., 5 tabs.

44620 (CONF-900936–1) **Radiation damage in Al_2O_3 crystals implanted with 3.8 MeV Fe^{2+} ions.** Chen, Y.; Abraham, M.M.; Pedraza, D.F. Oak Ridge National Lab., TN (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990. Order Number DE90016038. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sapphire (α-Al_2O_3) crystals were implanted with 3.8 MeV Fe^{2+} ions to fluences of 0.5×10^{16} and 2×10^{16} cm^{-2}. The sample face was perpendicular to the c-axis. The radiation damage produced by the implantation was investigated using optical and electron paramagnetic resonance (EPR) techniques. The former encompassed optical absorption and luminescene. The predominant defect detected optically was the oxygen vacancy with two electrons (F center), identified by an absorption peak at 6.2 eV (~200 nm). The paramagnetic oxygen vacancy with one electron (F^{plus} center) absorbs at 4.8 eV (~260 nm) and was identified by EPR. Divacancies in various charge states were present in much lower concentrations and could not be unambiguously identified by optical absorption. Instead, they were detected by the highly sensitive luminescence measurements. Upon isochronal annealing between 500 and 1200 K, the concentration of the F center decreased monotonically. No evidence of the F^+-center was found after annealing at 800 K. On the other hand, the concentration of the higher order defects initially increased, presumably at the expense of the oxygen vacancies, and subsequently also decreased. 12 refs., 5 figs., 1 tab.

44621 (CONF-901009–1) **Self-lubricating boric acid films for tribological applications.** Erdemir, A.; Fenske, G.R.; Nichols, F.A.; Erck, R.A.; Busch, D.E. Argonne National Lab., IL (USA). [1990]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Japan international tribology conference; Nagoya (Japan); 29 Oct - 1 nov 1990. Order Number DE90007805. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Because of its layered crystal structure, boric acid, has been found to be lubricious. Its self-lubricating mechanism is related to the easy shear of atomic layers over one another. Moreover, laser-Raman spectroscopy and electron microscopy analyses have confirmed that thin boric acid films can form on surfaces containing boron and boric oxides. To study the lubricity and self lubricating mechanism of boric acid, pin-on-disk tests were performed on pairs of boric acid compacts and steel disks, boric oxide films and steel pins, boron films and steel pins, and boron-implanted steel disks

and steel pins. The mean steady-state friction coefficients of these tribosystems ranged from 0.04 to 0.12. 22 refs., 4 figs., 4 tabs.

44622 (CONF-901009–2) **Wear reduction in cutting tools: Tribological properties of hard coatings.** Bandyopadhyay, B.P. (North Dakota Univ., Grand Forks, ND (USA)); Fabiszak, E.; Fenske, G.R.; Nichols, F.A. Argonne National Lab., IL (USA). [1990]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Japan international tribology conference; Nagoya (Japan); 29 Oct - 1 nov 1990. Order Number DE90009705. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The cutting tool industry has become the pioneer in the use of hard coatings on different types of tools. Hard coatings, which improve the performance and lifetime of cutting tools, have been used for more than 20 years. In the study reported here, performance evaluations were made of high-speed steel and carbide tool inserts that were coated with tungsten disulfide (WS_2), titanium nitride (TiN), and with TiN and then with WS_2; uncoated inserts were also evaluated. The aim was to determine whether the WS_2 coating improved tool life and reduced cutting-force requirements. The WS_2-coated inserts demonstrated significantly lower flank wear than the uncoated inserts. Use of WS_2 also reduced flank and notch wear of uncoated and TiN-coated inserts. The greatest wear reductions were observed for inserts coated with both TiN and WS_2.

44623 (CONF-901026–1) **Modified 9Cr-1Mo steel for advanced steam generator applications.** Brinkman, C.R.; Alexander, D.J.; Maziasz, P.J. Oak Ridge National Lab., TN (USA). [1990]. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From ASME/VGE international power plants conference; Boston, MA (USA); 21-25 Oct 1990. Order Number DE90010497. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results are reported from several types of mechanical property tests conducted on a number of commercial heats of modified 9Cr-1Mo steel. Data from long term creep-rupture tests conducted on base and weldment material were compared with an analytical model which has been shown to give good agreement between measured and predicted values. Weldment material had somewhat inferior creep-rupture strength in comparison to base material due to a soft zone at the edge of the HAZ. Data are presented from elevated temperature tensile and creep-rupture tests conducted n material thermally aged for periods of up to 75,000 h (8.6 years). Some reduction in strength was shown to occur in comparison to unaged material. Models were developed for predicting the reduction in short term elevated temperature tensile and yield strength for material thermally aged in the temperature range of 482 to 704°C. Results from Charpy impact tests conducted on material thermally aged at 538°C for periods of up to 75,000 h showed an increase in the ductile-brittle transition temperature. Finally, results from transmission electron microscopy studies were presented to explain changes in mechanical properties due to thermal aging. These observations showed that Laves phase precipitation and recovery occurs on prolonged exposure of this alloy in this temperature range. 9 refs.

44624 (CONF-901034–1) **Multiaxial fatigue criterion for 2-1/4 Cr-1 Mo steel for use in high-temperature structural design.** Blass, J.J. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From ASME/IEEE joint power generation conference; Boston, MA (USA); 21-25 Oct 1990. Order Number DE90016039. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An improved multiaxial fatigue failure criterion is described that is based on a definition of equivalent inelastic strain range incorporating the shear and normal components of inelastic strain range on the planes of maximum inelastic shear strain range. Optimum values of certain parameters contained in the formulation were obtained by the method of least squares from the results of combined axial-torsional strain cycling test of 2–1/4 Cr-1 Mo steel conducted at 538°C (1000°F). The ability of this criterion to correlate the test results was compared with that of the Mises equivalent inelastic strain range criterion and was found to be superior. A procedure is described for calculating the required shear and normal components of strain range under general multiaxial strain cycling conditions. An improved definition of equivalent total strain range based on these considerations is directly applicable to the method of estimating fatigue damage in ASME Code Case N-47. 17 refs., 5 figs., 1 tab.

44625 (CONF-901071–1) **Ion-beam mixing of Fe/B layers for tribological applications.** Fenske, G.R.; Hu, R.; Baldo, P.M.; Erck, R.A.; Erdemir, A.; Lee, R.H.; Busch, D.E.; Nichols, F.A.; Rehn, L.E. Argonne National Lab., IL (USA). [1990]. 39p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990. Order Number DE90010091. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ion-beam mixing of iron and boron deposited layers was investigated as a technique to produce improved tribological coatings on steel substrates. Analysis of the kinetics of the ion-mixing process indicated that processing temperatures between 300 and 450°C were required to achieve mixing of iron and boron multilayered coatings. During film deposition, it is critical to avoid deposition processes such as rf sputtering that trap large quantities of inert gases in the growing films and form blisters during subsequent ion mixing at elevated temperatures. Tribological evaluation of annealed and ion-mixed coatings indicated that the major effect of the ion mixing is formation of hard, wear-resistant, polycrystalline Fe_2B and Fe_3B phases at 450°C and amorphous layers at 300°C. Under partially lubricated conditions, the hard phases increase the duration of a low-friction (coefficient of friction <0.2) regime by reducing wear, thereby maintaining a low surface roughness. Under boundary-lubrication conditions, reduced wear was observed in tests on ion-mixed samples and was found to be dependent on the humidity in the test environment. 16 refs., 9 figs., 3 tabs.

44626 (CONF-901071–5) **Scale effects in steady-state friction.** Blau, P.J. Oak Ridge National Lab., TN (USA). [1990]. 28p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990. Order Number DE90012943. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sliding friction phenomena have long been the subject of study and modeling. The physical portrayal of the sliding contact upon which such models are based is often a function of the modeler's background, and may range from the atomic scale to the scale of more macroscopic surface roughness. Sometimes, quasi-static arguments are inappropriately applied to sliding situations. The current paper examines the nature of frictional variations during sliding contact. High recording-rate instrumentation was used to analyze detailed, point-to-point variations in friction force for self-mated, pin-on-disk experiments with alumina and aluminum specimens. Data indicate that friction mechanisms, even on a fine scale, must be modeled considering the whole tribosystem, not just the interfacial materials properties alone. The contact conditions stimulate the displacements in the tribocomponents, which in turn result in sensible mechanical output. It is physically unrealistic to develop sliding solid friction models which predict only a single friction value, rather a range of values typical of the variation experienced by the dynamic tribosystem should be developed. A systems approach rather than a "discrete asperity" approach may ultimately prove to be must productive for modeling tribosystems of engineering interest. 17 refs., 14 figs., 3 tabs.

44627 (DOE/ER/45253–5) **Physical and electronic structure of the electrolyte-solid interface through optical phenomena: Progress report, January 1, 1989–June 30, 1990.** Furtak, T.E. Colorado School of Mines, Golden, CO (USA). Dept. of Physics. Jul 1990. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45253. Order Number DE90015935. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This progress report outlines the work accomplished since the inception of the grant, concentrating on the accomplishments since the last report, which was issued 18 months ago. Our goal has been to develop and exploit new techniques, primarily optical, which can be used to reveal the microscopic details of the electrolyte-solid interface. The most significant recent advance has been in the area of second harmonic reflectance spectroscopy. We

have completed initial studies of the Ag(111) electrode in which the anisotropic character of the second order effect was used to extract the essential susceptibility contributions as a function of the incident photon energy. Other studies along this direction include an in-depth treatment of Cd on Ag(111). In summary, we have reached our goal of establishing a multi-technique approach to the study of elementary excitations as the electrolyte-solid interface. We have explored several central phenomena involving these probes and have made good progress toward understanding the optical interactions with a detail not previously achieved. We are now well situated to continue this investigation through additional work on the fundamental optical effects in some well-defined systems which are of central importance.

44628 (DOE/NE/37963–12) **Deformation effects on the development of grain boundary chronium depletion (sensitization) in type 316 austenitic stainless steels.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA)); Wood, W.E.; Advani, A.H.; Bruemmer, S.M. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA). [1990]. 263p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-86NE37963. Order Number DE90016130. Source: NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.

Deformation induces an acceleration in the kinetics and reduction in the thermodynamic barrier to carbide precipitation and grain boundary chromium depletion (GBCD) development of a high carbon Type 316 stainless steel (SS). This was observed in a study on strain effects on GBCD (or sensitization) development in the range of 575°C to 775°C. Grain boundary chromium depletion behavior of SS was examined using the indirect electrochemical potentiokinetic reactivation (EPR) test and supported by studies on carbide precipitation using transmission electron microscopy (TEM). 99 refs., 84 figs., 9 tabs.

44629 (EGG-SCM–7684) **Short-term thermal response of rapidly solidified Type 304 stainless steel containing helium.** Clark, D.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jun 1988. 28p. Sponsored by U.S. Department of the Interior. DOE Contract AC07-76ID01570. JO134035. Order Number DE90015470. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Type 304 stainless steel was heat treated for short times near its melting point in order to determine its microstructural response to thermal cycles typical of the near heat-affected zones of welding processes. The material was rapidly solidified as a powder by centrifugal atomization in a helium environment and consolidated by hot extrusion. Along with the ingot metallurgy material used for canning the powder prior to hot extrusion, it was heat treated using a Gleeble at temperatures of 1200 and 1300°C for times ranging from <1 to 1000 s, and the samples were examined for microstructure and the existence of porosity due to entrapped helium. At higher test temperatures and longer treatment times, the material developed extensive porosity, which was stabilized by the presence of helium and which may also have a role in anchoring grain boundaries and inhibiting grain growth. The powder material. At lower test temperatures and shorter treatment times, grain growth in the γ phase appeared to be restricted in the powder material, possible by the presence of helium. An intermediate temperatures and times, a γ-δ duplex microstructure also restricted grain growth again occurred in the δ microstructure. 9 refs., 14 figs., 3 tabs.

44630 (EUR–12061) **Co-production of liquid iron and synthesis gas in smelting reduction: Demonstration project: Final report.** Robson, A.L. (British Steel Corp., Teesside (UK)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; British Steel Corp., Teesside (UK). 1989. 55p. Sponsored by Commission of the European Communities. Contract LG/069/85. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 6.25.

The aim of the project was to carry out a pilot scale investigation and an engineering design feasibility study to develop a process route for the co-production of liquid iron and a predominantly sulphur-free gas consisting mainly of carbon monoxide and hydrogen from inputs of iron, iron ore, coal and oxygen. These twin products should provide a synergistic economic advantage over other methods of producing synthesis gas from coal, together with a low capital cost route for liquid iron production. By achieving flexibility in terms of the selection of raw materials and operating parameters,then variations in the liquid iron: gas outputs should be possible to meet the fluctuating demands of either product. On the pilot plant a programme of individual experiments were planned to demonstrate extended pilot plant operation for a variety of feed combinations after first establishing the engineering and process performance of a continuously operating, coal-based smelting reactor. The engineering feasibility study was carried out in parallel to the pilot plant work and consisted of an evaluation of engineering design proposals for the erection and operation of an intermediate sized works-based smelting reduction demonstration plant.

44631 (IAEA-R–4539-F) **Galvanic corrosion evaluation of high activity nuclear waste container metals components: Final report for the period 1 December 1987 - 30 November 1989.** Semino, C.J. Comision Nacional de Energia Atomica, Buenos Aires (Argentina); International Atomic Energy Agency, Vienna (Austria). Apr 1990. 71p. Order Number DE90636567. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The final disposal container for vitrified high-level waste is assumed to have three metallic layers: a stainless steel inner layer, and external one of a metal to be selected and a thick lead layer (10 cm) in the middle. As design limit, the container shall act as an engineering barrier, granting the isolation of the radionuclides for approximately 1000 years. Preliminary titanium-lead galvanic couple tests showed that titanium behaved always as a cathode in the galvanic couple, promoting the galvanic corrosion of lead. This corrosion study focused on the behaviour of lead-AISI 304 stainless steel and lead-carbon steel (SAE 1010 and 1020) galvanic couples with different area relationships, temperature and media composition. High purity lead (99,999%) and commercial lead (99,9%) were used for galvanic couples tests. Tests were performed at 75, 50, 45 and 40 deg. C. Test solution was either synthetic groundwater, a suspension of 10% bentonite in groundwater, or synthetic sea water. The synthetic sea water was used at 100, 50 and 25% concentration by dilution with distilled water. Tests with lead-304 stainless steel galvanic couples showed that lead always behaves as an anode, corroding preferentially. Very low lead corrosion rates were found in lead-carbon steel galvanic couple in 10% bentonite suspension in synthetic groundwater test at 75 deg. C. An increase of carbon content in steel has very little influence on steel corrosion rate. Commercial lead has a higher corrosion rate and presented a more pronounced attack than high purity lead. Its corrosion rate is at least twice when lead-carbon steel area relationship increases from 1:10 to 1:40. There are higher steel corrosion rates in sea water than in groundwater. Lead behaves as a cathode to the end of the test. 8 refs, 85 figs, 10 tabs.

44632 (JAERI-M–90-014) **The transverse stress effect on the critical current of jelly-roll multifilamentary Nb_3Al wires.** Zeritis, D. (Massachusetts Inst. of Tech., Cambridge, MA (USA)). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. 60p. Order Number DE90513710. Source: NTIS (US Sales Only), PC A04/MF A01.

Experiments were conducted to determine the transverse stress sensitivity of the critical current of jelly-roll multifilamentary Nb_3Al wires, primarily at 12T but also at other magnetic fields. For comparison, similar experiments were conducted on bronze-process Ti-alloyed multifilamenary Nb_3Sn wires. In total four samples were experimented upon, twojelly-roll Nb_3Al samples of 0.8 mm and 1.03mm diameter, respectively, one bronze-process Nb_3Sn sample of 1.0 mm diameter, and one internally-stabilized bronze-process Nb_3Sn sample of 1.09 mm diameter. As was expected, the Nb_3Al samples proved vastly superior to the Nb_3Sn samples with regard to transverse compressive stress, exhibiting significant I_c-degradation for transverse stresses above 100MPa. At 12T and at 150MPa of transverse compression - conditions expected in fusion magnets - the 0.8 mm-diameter sample exhibited an I_c-degradation of $\approx$20 %, whereas the 1.03 mm-diameter sample of $\approx$28 %. Under the same conditions, the 1.0 mm-diameter Nb_3Sn sample exhibited an I_c-degradation of $\approx$65 %, whereas at 12T and 120MPa the 1.09 mm-diameter Nb_3Sn sample exhibited an I_c-degradation also of

≈65 %. However, the measured non-copper critical current densities at high magnetic fields of the Nb_3Al samples were lower than those of the Nb_3Sn samples. Further development is needed to improve this aspect of their performance, nevertheless there is optimism that Nb_3Al will eventually become a useful superconductor for large-scale, high-field applications. (author).

44633 (JAERI-M–90-026) **Preparation of certified reference material for determination of oxygen and nitrogen in zirconium alloys, JAERI-Z20.** Hoshino, Akira (ed.) (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. 34p. (In Japanese). Order Number DE90513608. Source: NTIS (US Sales Only), PC A03/MF A01.

The Committee on Analytical Chemistry Nuclear Fuels and Reactor Materials, JAERI, has issued many Certified Reference Materials, such as uranium and its oxide, zirconium and its alloys, and high temperature alloys, since 1963. Preparation, analysis and certification of a Certified Reference Materials, JAERI-Z20, is described in this paper. This material, Zircaloy-2, is in the form of bar (6 x 6 x 50 mm). It is intended for calibrating inert gas fusion equipments used in the determination of oxygen and nitrogen in zirconium alloys. In the analytical work for certification, determinations of oxygen were performed by inert gas fusion, and those of nitrogen were by titration method and thymol photometric method. Certified values of oxygen and nitrogen are 0.128 and 0.0036 wt% for JAERI-Z20, respectively. The value of hydrogen, 5.3 $\pm$ 1 ppm, is not certified, but is given for information only. (author).

44634 (JAERI-M–90-037) **Experiments on tritium behavior in beryllium, (3): Development of method for measuring tritium distribution in beryllium.** Tatenuma, Katsuyoshi (Kaken Co. Ltd., Tokyo (Japan)); Kawamura, Hiroshi; Ishizuka, Etsuo; Sakamoto, Naoki; Nakata, Hirokatsu. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 36p. (In Japanese). Order Number DE90513744. Source: NTIS (US Sales Only), PC A03/MF A01.

It is necessary to understand the tritium behavior in Be, in the case that Be is used as the neutron multiplier in fusion reactor. Therefore, the electrolytic polishing method was examined to determine tritium distribution in Be. In the preliminary experiment, we examined for the effect of the polishing solution, the distance between two electrodes, the temperature and stir of the polishing solution and current density for polishing. In the next experiment, the suitable polishing condition, i.e. the relation between voltage and current density was examined. Under this condition, the various tests were conducted to get the relation between electric quantity and the polished depth of Be or generated hydrogen volume, and the treatment efficiency of generated hydrogen. Furthermore, the tritium analysis in polishing solution were examined. From the results, the polishing condition was determined and the possibility of measuring tritium distribution in Be was ascertained. (author).

44635 (LA-UR–90-2516) **Beryllium weldability.** Hill, M.A. (Los Alamos National Lab., NM (USA)); Damkroger, B.K.; Dixon, R.D.; Robertson, E. Los Alamos National Lab., NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-901095–4: ASM fall meeting, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90014696. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Welding processes and metallurgical considerations for beryllium welding are discussed in this review. The primary difficulties of welding beryllium are hot cracking, cracking at defects, and ductility limitation or thermally induced cracking. Solutions to these welding problems include control of the Fe/Al ratio in the base metal to reduce hot cracking, minimization of the BeO content and starting grain size to limit cracking at defects and ductility limitation cracking, and optimization of the welding process and process variables. 25 refs., 9 figs., 2 tabs.

44636 (LA-UR–90-2567) **The plutonium-oxygen phase diagram.** Haschke, J.M. Los Alamos National Lab., NM (USA). [1990]. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-900846–1: International symposium to commemorate the 50th anniversary of discovery of transuranium elements, Washington, DC (USA), 26-31 Aug 1990). Order Number DE90014980. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Identification of products formed by the reaction of plutonium metal with liquid water at 23°C indicates that the plutonium-oxygen phase diagram is similar to the cerium-oxygen and praseodymium-oxygen diagrams. Quantitative measurements of H_2 formation and analytical data suggest that a sequence of hydrolysis reactions produces oxide hydrides of trivalent plutonium, Pu_2O_3, mixed-valent oxides and PuO_2. The intermediate oxides are the n = 7, 9, 10 and 12 members of the Pu_nO_{2n-2} homologous series. Properties of the residue formed by thermal decomposition of the initial hydrolysis product, plutonium monoxide monhydride (PuOH), are consistent with the formation of metastable plutonium monoxide. Crystal-chemical, thermodynamic, and kinetic factors are evaluated, but definitive assignment of the equilibrium Pu-O diagram is not possible. 22 refs., 6 figs., 1 tab.

44637 (LBL–28954) **Nucleation of copper films on platinum: Effect of benzotriazole.** Armstrong, M.J. (Lawrence Berkeley Lab., CA (USA)); Muller, R.H. Lawrence Berkeley Lab., CA (USA). Apr 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-901073–5: 178. meeting of Electrochemical Society, Inc., Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90014035. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The sub-micron topography of Cu deposits during the initial stages of deposition was studied with scanning tunneling microscopy (STM) to investigate the effect of benzotriazole (BTA). The brightness of a surface, characterized by a low intensity of scattered light, has been related to its topography. Additives such as benzotriazole are used in plating baths to reduce the roughness. The average particle size in a deposit can be determined by dividing the deposition rate by the nucleation rate. In this study the number density of nuclei of Cu on Pt was derived from Fourier transforms of the STM data from 54 Å thick Cu films. The effects of BTA concentration and overpotential on the Cu number density of nuclei were determined. 2 refs., 4 figs.

44638 (LBL–29034) **Transmission electron microscopy study of ICB Al on Ge and Si(001) substrates.** Dahmen, U.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Apr 1990. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9006255–1: ISIAT '90, Tokyo (Japan), 4-8 Jun 1990). Order Number DE90015299. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ionized Cluster Beam (ICB) deposition is a novel technique for the production of thin films with interesting and unusual structures and properties. Its development effort has been spearheaded at Kyoto University, but interest in the technique has become widespread in recent years. At Berkeley, research is underway to characterize and understand the structure of interfaces in such films. Transmission electron microscopy (TEM) is being employed to obtain images of the atomic structure and the defects typical for these materials with the aim of understanding the relationship between deposition conditions and the structural characteristics of such interfaces. A question of fundamental importance in the formation of high-quality films is how the crystal structures of the substrate and the overlayer affect the epitaxial orientation relationship between them. In this study we present a comparison between Al films grown on two different substrates: (001) Si and (001) Ge. The interface structures are characterized in plan view by conventional microscopy using diffraction and moire contrast and in cross section by high resolution microscopy. Thin films of Al grown on (001) Si are found to be distinctly different from Al films grown on (001) Ge substrates. The relationship between interfaces produced by precipitation reactions in Al–Si and Al–Ge alloys.

44639 (MLM–3650(OP)) **An effective low-profile thermite torch.** Mohler, J.H. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)); Halcomb, D.L.; Begeal, D.R. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900792–13: 15. international pyrotechnics seminar, Boulder, CO (USA), 9-13 Jul 1990). Order Number DE90015746. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A thermite torch was designed and built for use in a space-limited environment. The intended application required that a series of these torches be ignited from a single, external pyrotechnic source. Novel design features and optimized use of a single thermite formulation made it possible to achieve the required performance, within the constraints of the application system. 2 refs., 7 figs.

44640 (MTU-TB–81/251) **Low pressure plasma spraying (LPPS) of coatings to give protection against corrosion by hot-gases. Final report.** Wilms, V. Motoren- und Turbinen-Union GmbH, Muenchen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). [1982]. 50p. Contract BMFT 01-ZB-167. Source: Copy held by UB/TIB Hannover.

The LPPs-coatings of MCrAlY-type exhibit an improved oxidation and sulfidation resistance, partially derived from better adherence of the protective Al_2O_3 and Cr_2O_3 layers attributed to the presents of yttrium. This yttrium has a keying action thereby contributing to a higher overall rigidity of the coating. It was the object of this research to optimize the coating and after treatment process and to try to formulate a new coating alloy. Due to extensive costs, the substrate materials have been reduced to two (IN-100 and B-1900 mod.). It was possible to optimize the coating process to such a stage, that the coatings can be applied evenly on all areas to be coated with a thickness of 150+20 μm in 20 seconds (RB199IPT-blade). In addition to this a new technique has been developed to finish the coating surface to a desired surface roughness with controlled coating removal. In the as sprayed condition the roughness being R_a=6-9 μm and after finishing lowering it to R_a=0.5-0.8 μm. After exposure of the coated blades to a JP-4 atmosphere at 1220 K a metallographic examination was performed. The results of which were very promising. However, the newly formulated S-57 mod. material (34Ni25Co25Cr10Al5Ta0.5Y) exhibited the same negative artifacts as the diffusion aluminide coatings when exposed to higher temperatures. The main one being the formation of a needle like phase identified as $M_{23}C_6$ and not a σ-phase, as which it is sometimes falsely classified. (orig./MM) With 24 figs., 3 tabs.

44641 (N–90-21849) **The effect of hydrogen and microstructure on the deformation and fracture behavior of a single crystal nickel-base superalloy. Final report Ph.D. Thesis.** Walston, W.S. Carnegie-Mellon Univ., Pittsburgh, PA (USA). Apr 1990. 254p. (NASA-CR–185219;NAS–1.26:185219). Source: NTIS, PC A12/MF A02.

A study was conducted on the effects of internal hydrogen and microstructure on the deformation and fracture of a single crystal nickel-base superalloy. In particular, room temperature plane strain fracture toughness and tensile tests were performed on hydrogen-free and hydrogen charged samples of PWA 1480. The role of microstructure was incorporated by varying the levels of porosity and eutectic gamma/gamma prime through hot isostatic pressing and heat treatment. The room temperature behavior of PWA 1480 was unusual because precipitate shearing was not the primary deformation mechanism at all strains. At strains over 1 percent, dislocations were trapped in the gamma matrix and an attempt was made to relate this behavior to compositional differences between PWA 1480 and other superalloys. Another unique feature of the tensile behavior was cleavage of the eutectic gamma/gamma prime, which is believed to initiate the failure process. Fracture occurred on (111) planes and is likely a result of shear localization along these planes. Elimination of the eutectic gamma/gamma prime greatly improved the tensile ductility, but pososity had no effect on tensile properties. Large quantities of hydrogen (1.74 at. percent) were gas-phase charged into the material, but surprisingly this was not a function of the amount of porosity or eutectic gamma/gamma prime present. Desorption experiments suggest that the vast majority of hydrogen is at reversible lattice trapping sites. This large, uniform concentration of hydrogen dramatically reduced the tensile strain to failure, but only slightly affected the reduction in area. Available hydrogen embrittlement models were examined in light of these results and it was found that the hydrogen enhanced localized plasticity model can explain much of the tensile behavior. K(IC) fracture toughness tests were conducted.

44642 (ORNL/FTR–3710) **[X-ray and synchrotron source investigations]: Foreign trip report, July 18, 1990–August 3, 1990.** Larson, B.C. Oak Ridge National Lab., TN (USA). 17 Aug 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015833. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended the 15th International Union of Crystallography Congress and presented a paper entitled "Characterization of Precipitates Using High-Order X-Ray Diffuse Scattering." Of particular interest to the traveler and to programs at ORNL was the increasing application of synchrotron x-ray sources, progress in structural determinations for quasi-crystalline and incommensurate materials, scattering-phase determinations applied to imperfect crystals, including protein crystals, developments in the area of magnetic x-ray scattering, and the status of two-dimensional x-ray detectors and x-ray imaging plates. The traveler made site visits to the Technical University of Zuerich for discussions relating to solute precipitation and short-range ordering in metal alloys, to the University of Muenich for discussions on x-ray investigations of damage production in metals by energetic particles, and to the Technical University of Muenich for discussions on Moessbauer and magnetic x-ray investigations.

44643 (PB–90-233495/XAB) **Distribution and influence of impurities in tungsten heavy metals.** Ekbom, L.B. Forsvarets Forskningsanstalt - FOA, Stockholm (Sweden). Mar 1990. 11p. (FOA-C–20787-2.3). Source: NTIS, PC EE03/MF E03.

Tungsten heavy metals are particle composites produced by liquid phase sintering. The ductility of the alloy is sensitive to the impurity content and to heat treatment process. Some impurities become concentrated to the interphase boundaries. Such elements are phosphorus and sulfur but also oxides of aluminum and silicon. Also small amounts of oxygen, carbon and hydrogen are deleterious. Ion microprobe analysis, SIMS, has been used to determine the distribution of alloying elements and impurities. The relation between the content of different elements in the particles and in the matrix was also determined.

44644 (PB–90-873043/XAB) **Neodymium-iron-boron (Nd-Fe-B) permanent magnets. January 1984-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1984-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 177p. Source: NTISPC N01/MF N01.

Supersedes PB–89-863450.

This bibliography contains citations concerning the development, fabrication, and applications of neodymium-iron-boron (Nd-Fe-B) permanent magnets. Topics include magnetization and aging of magnets, crystal structure and magnetic properties, coercivity of Nd-Fe-B magnets, magnetic hardening mechanism, and high and low temperature properties of Nd-Fe-B magnets. Applications of Nd-Fe-B permanent magnets in electrical machines, magnetomechanical devices, and medical and dental devices are presented. (This updated bibliography contains 315 citations, 49 of which are new entries to the previous edition.)

44645 (PB–90-873704/XAB) **Tungsten and tungsten alloy powder metallurgy. March 1986-May 1990 (A Bibliography from the COMPENDEX data base). Report for March 1986-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 157p. Source: NTISPC N01/MF N01.

Supersedes PB–87-867768.

This bibliography contains citations concerning tungsten powder preparation and processing. Studies include sintering, densification, shrinkage, phase analysis, and heat treatment. The physical and mechanical properties of tungsten powder metal products are included. The effects of additives and particle size on the sintering and sintered articles are also described. (This updated bibliography contains 349 citations, 194 of which are new entries to the previous edition.)

44646 (PNL-SA–17175) **Swelling of neutron irradiated vanadium alloys.** Loomis, B.A. (Argonne National Lab., IL (USA)); Smith, D.L.; Garner, F.A. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830 ;W-31109-ENG-38. Order Number

DE90015294. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The swelling of V-10.0Cr-0.1Al, 1Cr-0.3Al, V-3.1Ti-0.3Si, V-4.9Ti, V-14.4Ti, V-17.7Ti, V-20.0Ti, V-14.4Cr-0.3Ti-0.3Al, V-14.1Cr-1.0Ti-0.3Al, V-13.7Cr-4.8Ti, V-9.0Cr-3.3Fe-1.2Zr (Vanstar-7), V-14.5Ti-7.2Cr, V-8.6W, V-4.0Mo, and V-12.3 Ni alloys and unalloyed V was determined after neutron irradiation at 420°C and 600°C to irradiation damage levels ranging from 17 to 77 dpa in the FFTF-MOTA reactor facility. The swelling of these alloys was obtained from a determination of the density for the unirradiated and irradiated alloys on immersion in CCl_4. The swelling of unalloyed V at 600°C was substantially increased by the addition of Cr. The addition of either Ni, W, or Mo to V had relatively minor effect on the swelling of V. The swelling of the V-Cr-Ti alloys was strongly dependent on the Ti concentration. The swelling of the V-3.1Ti-0.3Si and V-14.4Ti alloys at 600°C was greater than that exhibited by the other binary V-Ti alloys. The Vanstar-7 alloy underwent larger swelling that the V-Ti and V-Cr-Ti alloys. For the binary V-Ti alloys and the ternary V-Cr-TI alloys, the dependence of swelling on the amount of irradiation damage was <0.1% swelling per dpa.

44647 (PNL-SA–17876) **Properties of reactively-deposited SIC and GeC alloys.** Martin, P.M.; Johnston, J.W.; Bennett, W.D. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 8p. Sponsored by U.S. Department of Defense; U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900756–35: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90016363. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thin-film silicon carbide (Si_xC_{1-x}) and germanium carbon (Ge_xC_{1-x}) alloy coatings with low infrared optical absorption have been fabricated by dc- and rf-reactive magnetron sputtering. The optical and mechanical properties of the coatings depend on composition determined by deposition conditions. The refractive index and optical absorption coefficient of Si_xC_{1-x} alloys were varied from those of amorphous SI to those near diamond-like carbon (DLC) by increasing C content. The band edge shifted below 1.2 eV with C content as high as 0.8. The useful range of the Si_xC_{1-x} coatings was extended to wavelengths as low as 1 μm. The useful transparency range of Ge_xC_{1-x} coatings is from 3 to 12 μm. The refractive index of Ge_xC_{1-x} coatings was varied from 4.2 of amorphous Ge to near 3.4 by increasing x from 0 to 0.5. The optical absorption coefficient was a complex function of composition and C-H, Ge-H, and Ge-C bonding. Mechanical stress in both materials was generally moderate, and increased with increasing C content for the GeC alloys and decreased with increasing C or the SiC alloys. The wide range of optical properties obtainable for both coating types makes them useful in many types of multilayer designs. Abrasion-resistant infrared (IR) multispectral antireflection coatings on zinc sulfide (ZnS) were demonstrated using $Ge_{0.9}C_{0.1}$ and DLC layers. 6 refs., 6 figs., 2 tabs.

44648 (RFP–4390) **Penetration in GTA welding.** Heiple, C.R.; Burgardt, P. EG and G Rocky Flats, Inc., Golden, CO (USA). [1990]. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-901008–1: Fall meeting of the Minerals, Metals and Materials Society on physical metallurgy and materials in conjunction with materials week and the material applications and services exposition, Detroit, MI (USA), 7-11 Oct 1990). Order Number DE90008971. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The size and shape of the weld bead produced in GTA welding depends on the magnitude and distribution of the energy incident on the workpiece surfaces as well as the dissipation of that energy in the workpiece. The input energy is largely controllable through the welding parameters selected, however the dissipation of that energy in the workpiece is less subject to control. Changes in energy dissipation can produce large changes in weld shape or penetration. Heat transport away from the weld pool is almost entirely by conduction, but heat transport in the weld pool is more complicated. Heat conduction through the liquid is an important component, but heat transport by convection (mass transport) is often the dominant mechanism. Convective heat transport is directional and changes the weld pool shape from that produced by conduction alone. Surface tension gradients are often the dominant forces driving fluid flow in GTA weld pools. These gradients are sensitive functions of weld pool chemistry and the energy input distribution to the weld. Experimental and theoretical work conducted primarily in the past decade has greatly enhanced our understanding of weld pool fluid flow, the forces which drive it, and its effects on weld pool shape. This work is reviewed here. While less common, changes in energy dissipation through the unmelted portion of the workpiece can also affect fusion zone shape or penetration. These effects are also described. 41 refs., 9 figs.

44649 (SAND–90-0883C) **Dynamic yield strength and spall strength measurements under quasi-isentropic loading.** Chhabildas, L.C.; Asay, J.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9008125–3: Explomet conference, San Diego, CA (USA), 12-17 Aug 1990). Order Number DE90016105. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper, measurements on the quasi-isentropic compression of tantalum and tungsten to stress levels of 60 GPa and 250 GPa, respectively, are reported. Results of these experiments have been compared to those obtained under shock loading conditions. These experiments have allowed the determination of temperature, pressure, and loading effects on the dynamic yield strength of tungsten and tantalum up to 250 GPa and 80 GPa, respectively. The results show that the dynamic yield strength of tungsten is dependent on the loading rate with the strength being higher for the slower rates of loading along the quasi-isentrope. The pressure dependence of the yield strength of tungsten is determined nearly independent of temperature effects from quasi-isentropic loading experiments to 250 GPa, because the temperature rise in an quasi-isentropic loading experiment is much lower than that associated with shock loading experiments. For tantalum, quasi-isentropic loading experiments up to 60 GPa suggest that the dynamic yield strength is comparable to that determine under shock loading conditions up to 50 GPa. There is significant decrease in the dynamic yield strength for tantalum above 50 GPa under shock loading. A determination of spall strength for tantalum precompressed to 60 GPa under quasi-isentropic loading suggests an increase in spall strength when compared to the strength measurements in a shocked specimen at 20 GPa. 13 refs., 6 figs.

44650 (SAND–90-1006C) **Studies of the pressure induced transition from diffuse to constricted arcing in large vacuum arc furnaces.** Williamson, R.; Zanner, F.; Hareland, W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009192–9: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015693. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Vacuum arc remelting (VAR) is a secondary melting process used to produce superalloys. A dc arc is utilized to melt the alloy at normal pressures of ~1 Pa. However, in some instances the pressure in the region of the arc can reach abnormally high values due to CO evolution from the molten ingot, giving rise to a furnace condition known as "glow." This phenomenon was investigated by studying metal vapor arcs burning on 152 mm diameter Alloy 718 electrodes at 2.3 kA in a modified VAR furnace in CO ambients of 1.3, 13.3, and 66.7 Pa. Electrical signatures and high speed photographic data were recorded at all pressures. At the lowest pressure, the arc was diffuse with cathode spots distributed randomly across the molten electrode surface. Under these conditions, the inter-electrode space appeared to be uniformly filled with plasma. Monochromatic images taken at this pressure show mobile ion channels connecting regions of cathode spot activity with the molten ingot pool. Because spot motion is fast compared to the thermal diffusion speed in the ingot, this arc constitutes a quasi-uniform heat source necessary for successful application of the process. At a CO pressure of 66.7 Pa, the arc was localized and normal cathode spot action had ceased, although normal appearing constricted plasma attachments were observed to spontaneously appear at the bottom of molten metal protuberances as they dripped from the electrode and drew within a few millimeters

of the ingot surface. At this pressure, the arc was observed to operate in either of the two modes, one characterized by "high" voltage (−24 V), and the other by low voltage (−19 V). At 13.3 Pa CO the arc was not stable, although heating of the electrode remained quasi-uniform. 14 refs., 12 figs.

44651 (SAND–90-1335C) **A welding metallurgy study of Hastelloy Alloys B-2 and W.** Lienert, T.J. (Edison Welding Inst., Columbus, OH (USA)); Robino, C.V.; Hills, C.R.; Cieslak, M.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901095–1: ASM fall meeting, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90011910. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The weldability, solidification behavior, and solidification microstructures of Hastelloy× Alloy B-2 and Hastelloy× Alloy W have been investigated. Susceptibility to fusion zone hot-cracking was determined by autogenous Varestraint testing. High temperature phase transformations, including solidification events, were identified by differential thermal analysis (DTA). After testing, the microstructures of various specimens were examined by optical metallography, scanning electron microscopy (SEM), electron microprobe analysis, and analytical electron microscopy (AEM). Results of this study showed that Hastelloy B-2 has exceptional resistance to hot cracking, comparable to that of Hastelloy C-4 and 304 stainless steel, while Hastelloy W proved to be somewhat more susceptible to hot cracking, exhibiting behavior similar to Alloy 625. The solidification process in both Hastelloy B-2 and Hastelloy W was found to be dominated by the segregation of Mo which gives rise to the formation of terminal eutectic-like constituents. This pattern of segregation is consistent with that of previous work on other Ni–Mo–Cr alloys. The microstructural constituents associated with hot-cracking in each alloy have been identified. 13 refs., 8 figs.

44652 (SAND–90-1693C) **A weldability study of Haynes Alloy No 242.** Maguire, M.C.; Headley, T.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901095–3: ASM fall meeting, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90013875. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The weldability of Haynes ® Alloy No. 242 ™, a new alloy derived from the Ni-Mo-Cr system, was investigated. Susceptibility to fusion zone hot cracking was determined by Varestraint testing, and hot ductility was characterized by Gleeble testing. Solidification phase transformation data was recorded with differential thermal analysis (DTA). Weld microstructures were characterized with scanning electron microscopy (SEM), analytical electron microscopy (AEM), and electron probe microanalysis (EPMA). The results of this study indicate that this alloy has better hot cracking resistance than high strength nickel base superalloy 718; however, it has lower resistance than other alloys derived from the Ni-Cr-Mo ternary such as the Hastelloy alloys B2, C-4, C-22, C-276, and W. Segregation patterns in weld microstructures agree well with established information concerning this family of alloys. Prediction of solidification products with the Ni-Mo-Cr phase diagram based on a chemical equivalence was unsuccessful due to the higher carbon content of this alloy which favors the formation of M_6C. Solidification in Alloy 242 terminates with the formation of two eutectic-like constituents: (1) a M_6C/austenite eutectic, and (2) a second eutectic with austenite and an undetermined phase. This latter phase has a composition similar to the M_6C phase, but with a different crystal structure (cubic, ao = 6.6 Å). 11 refs., 10 figs., 4 tabs.

44653 (SAND–90-1694C) **Weldability of nickel and iron aluminides.** Ash, D.I. (Colorado School of Mines, Golden, CO (USA)); Edwards, G.R.; Maguire, M.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC04-76DP00789. (CONF-901095–2: ASM fall meeting, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90013498. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The weldability of alloys based on Ni_3Al and Fe_3Al is discussed. Both of these ordered alloy systems may experience problems associated with welding. In the case of Ni_3Al alloys, limited hot ductility contributes to heat-affected zone cracking. Fe_3Al alloys experience similar difficulties in zone cracking. Fe_3Al alloys experience similar difficulties in welding due to excessive grain embrittlement due to the presence of water vapor. Advances in both alloying and substructural refinement to improve the weldability are reviewed. 18 refs., 10 figs.

44654 (SAND–90-2135C) **Effect of nonequilibrium interface kinetics on cellular breakdown of planar interface during rapid solidification of Si-Sn.** Hoglund, D.E. (Harvard Univ., Boston, MA (USA)); Aziz, M.J.; Stiffler, S.R.; Thompson, M.O.; Tsao, J.Y.; Peercy, P.S. Sandia National Labs., Albuquerque, NM (USA). 26 Jul 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789 ;FG02-89ER45401. (CONF-900738–3: 8. American conference on crystal growth, Vail, CO (USA), 15-20 Jul 1990). Order Number DE90015694. Source: NTIS, PC A03/MF A01 - OSTI.

During rapid solidification, nonequilibrium interface kinetics alter the predictions of the Mullins-Sekerka theory for the stability of a planar interface against cellular breakdown. The velocity-dependence of the partition coefficient and of the Sn concentration at the onset of cellular breakdown have been measured during pulsed laser melting of Si–Sn alloys. The Mullins-Sekerka theory is modified by inserting a velocity-dependent partition coefficient and a velocity-dependent slope of the "kinetic liquids," both of which are extracted from the Continuous Growth Model for interface kinetics. These nonequilibrium interface kinetic effects increase the predicted critical concentration for cellular breakdown by two orders of magnitude for Sn in Si, and account fairly well for the experimental results. 34 refs., 3 figs.

44655 (SVF–361) **Inorganic coatings on stainless steel for protection against crevice corrosion.** Henrikson, Sture (SH-Korrosionskonsult, (Sweden)). Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden). Dec 1989. 22p. (In Swedish). Order Number DE90636568. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In order to create protection against crevice corrosion stainless steel test specimens of type 316 steel with various inorganic coatings applied on crevice surfaces were tested for 3-50 months at 25 and 30 degree C in natural seawater containing 0.2-1.5 ppm free chlorine. Various metallic coatings, Ni base alloys with Cr and Mo, Ni with W, pure Ag and pure Mo, as well as ceramic coatings - Cr_2O_3, TiO_2 and Al_2O_3 - were studied. All the coatings tested, except pure Molybdenum applied by plasma spraying in a max 0.1 mm thick layer were found to promote crevice corrosion of the stainless steel. A significant reduction of the crevice corrosion susceptibility was obtained with Molybdenum. The result is considered promising enough to justify full scale tests in seawater on flange joints of pipes, valves or pumps. (author).

44656 (UCRL–102337) **A comparative first principles study of phase stability in Ni-Ti and Ni-Al alloys around equiatomic composition.** Turchi, P.E.A. (Lawrence Livermore National Lab., CA (USA)); Sluiter, M.; Pinski, F.J.; Johnson, D.D. Lawrence Livermore National Lab., CA (USA). 1 Aug 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-900466–81: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90016477. Source: NTIS, PC A02/MF A01 - OSTI.

Electronic structure and phase stability properties of Ni-Ti and Ni-Al around equiatomic composition are investigated with a first principles approach. The study is based upon the generalized purturbation method applied to the Korringa-Kohn-Rostoker multiple scattering formulation of the coherent potential approximation. Within this framework, effective cluster interactions which build up the configuration-dependent part of the internal energy are calculated. The strength of ordering tendencies in both bcc-based substitutional alloys is compared and contrasted in terms of hybridization effects, in relation with experimental evidences. 8 refs., 3 figs., 2 tabs.

44657 (UCRL-JC–104189) **The influence of solidification rate on solute redistribution and second-phase formation in stainless steel alloys.** Elmer, J.W. (Lawrence Livermore National Lab., CA (USA)); Eagar, T.W.; Allen, S.M. Lawrence Livermore National Lab., CA (USA). 30 May 1990. 5p. Sponsored by U.S. DOE

Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9010159–1: 1990 American society of metals week materials weldability symposium, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90015189. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many common SS alloy microstructures consist of a mixture of ferrite and austenite phases, however, when these alloys are rapidly resolidified using laser beam (LB) or electron beam (EB) processes, they solidify in the single-phase-austenite or single-phase-ferrite mode. This paper investigates the influence of solidification rate on the reduction, and eventual elimination, of second phases during the rapid solidification of Fe-Ni-Cr alloys. The influence of solidification rate on the ferrite content of these alloys was studied by calculating the dendrite-tip undercooling and then incorporating these results into a solute-redistribution model. The calculations and experiments agree semi-quantitatively, allowing the relative fractions of primary and secondary phases that solidify from the melt to be calculated for a wide range of solidification rates. 7 refs., 1 fig.

44658 (UCRL-JC–104190) **Single-phase solidification during rapid resolidification of stainless steel alloys.** Elmer, J.W. (Lawrence Livermore National Lab., CA (USA)); Eager, T.W.; Allen, S.M. Lawrence Livermore National Lab., CA (USA). 30 May 1990. 9p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. N00014-80-C-0384. (CONF-901095–5: ASM fall meeting, Detroit, MI (USA), 6-12 Oct 1990). Order Number DE90015190. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The relative fractions of ferrite and austenite that solidify from a stainless steel (SS) alloy depend on the alloy composition and the solidification rate. Many common SS-alloy microstructures consist of a mixture of ferrite and austenite phases; however, when these alloys are rapidly resolidified using laser-beam (LB) or electron-beam (EB) processes, they solidify as single-phase austenite or single-phase ferrite. This paper investigates the influence of solidification rate on the reduction, and eventual elimination, of second phases during the rapid solidification of two Fe–Ni–Cr alloys. One alloy solidifies in the primary austenitic mode, and its ferrite content decreases to 0% with increasing solidification rate. The other alloy solidifies in the primary ferritic mode, and its ferrite content increases to 100% with increasing solidification rate. The influence of solidification rate on the ferrite content of these alloys was modeled by first calculating the dendrite-tip undercooling and then incorporating these calculations into a solute-redistribution model. The calculations and experiments agree semi-quantitatively, allowing the relative fractions of primary and secondary phases that solidify from the melt to be estimated for a wide range of solidification rates. The model predicts the minimum interface velocity for single-phase solidification to be about 40 mm/s, which correlates well with the experimental results for primary-austenite-solidified alloys but overestimates the minimum velocity for single-phase solidification of primary-ferrite-solidified alloys. 12 refs., 9 figs., 5 tabs.

44659 (UCRL-JC–104205) **Dimensional stability of superinvar.** Patterson, S.R. Lawrence Livermore National Lab., CA (USA). 27 Jun 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–30: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015199. Source: NTIS, PC A02/MF A01 - OSTI.

The unloaded dimensional stability and thermal expansivity of a single furnace melt of superinvar have been measured at room temperature using interferometric techniques. Thermal expansivity has been determined with an uncertainty of several parts in 10^8 per degree centigrade, while dimensional stability has been determined with an uncertainty of order one part in 10^9 per day. Samples subjected to plastic deformation in their processing history displayed a stability improvement from 20.5×10^{-6}/day to 5.5×10^{-9}/day and a reduction in thermal expansivity from 0.56×10^{-6}/°C to 0.23×10^{-6}/°C associated with the increased mechanical work in the material. 10 refs., 7 figs., 2 tabs.

44660 Surface-crack growth: Models, experiments, and structures; Proceedings of the Symposium, Sparks, NV, Apr. 25, 1988. ASTM Special Technical Publication, No. 1060. Reuter, W.G.; Underwood, J.H.; Newman, J.C. Jr. 429p. American Society for Testing and Materials, Philadelphia, PA (US) (1990). (CONF-8804331–: Surface-crack growth: models, experiments, and structures symposium, Sparks, NV (USA), 25 Apr 1988).

The present volume on surface-crack growth modeling, experimental methods, and structures, discusses elastoplastic behavior, the fracture analysis of three-dimensional bodies with surface cracks, optical measurements of free-surface effects on natural surfaces and through cracks, an optical and finite-element investigation of a plastically deformed surface flaw under tension, fracture behavior prediction for rapidly loaded surface-cracked specimens, and surface cracks in thick laminated fiber composite plates. Also discussed are a novel study procedure for crack initiation and growth in thermal fatigue testing, the growth of surface cracks under fatigue and monotonically increasing load, the subcritical growth of a surface flaw, surface crack propagation in notched and unnotched rods, and theoretical and experimental analyses of surface cracks in weldments.

44661 The modeling of gas phase permeation through iron and nickel membranes. Kuhn, D.K. (Cornell Univ., Ithaca, NY (USA)); Shanabarger, M.R. pp. 6 of Minerals, Metals, and Materials Society, international conference on hydrogen effects on material behavior. Minerals, Metals, and Materials Society, Moran, WY (US) (1989). (CONF-8909204–: 4. international conference on hydrogen effects on material behavior, Jackson Hole, WY (USA), 12-16 Sep 1989).

The gas phase permeation of hydrogen through metal membranes encompasses many kinetic processes. This paper reviews a permeation model which incorporates second order gas-surface reaction kinetics with simple bulk diffusion. The model is used to investigate the effect of this particular surface reaction of steady-state permeation. The dependence of the steady-state permeation flux on temperature, pressure, and thickness of the membrane has been calculated. The model predicts that the bulk controlled steady-state flux will change to a surface limited steady-state flux as either the temperature or thickness of the membrane is reduced. Finally, using independently derived parameters, the model is compared with permeation measurements on iron and nickel membranes. 18 refs.

44662 Compositional changes during ion bombardment. Kehn, L.E. (Argonne National Lab., IL (USA). Materials Science and Technology Div.). pp. 5-22 of Environmental degradation of ion and laser beam treated surfaces. Was, G.S.; Grabowski, K.S. The Metallurgical Society Inc., Warrendale, PA (USA) (1989). DOE Contract W-31-109-ENG-38. (CONF-880917–: Seminar on new approaches in practices and process technology for radiation sterilization of medical supplies, Laval (Canada), 25-29 Sep 1988).

Ion irradiation initiates several processes that can alter the composition of the target. This paper provides an overview of our current understanding of these kinetic processes, which include implantation, sputtering, displacement mixing, radiation-enhanced diffusion, and radiation-induced segregation. The latter two effects can alter the target composition to depths that are substantially greater than the projected ion range.

44663 Coble creep, cavity sintering, and cavity growth. Schneibel, J.H. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.); Martinez, L. pp. 296-308 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract AC05-84OR21400. (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

The close relationships between Coble creep, cavity sintering and cavity growth are discussed. The measurement of size distributions of crack-like cavities is useful for determining grain boundary and surface diffusivities. In nickel aluminide (Ni_3Al) intermetallics the grain boundary diffusivity determined in this manner agrees well with that obtained from Coble creep measurements. A critical comparison of the zero-creep technique and the zero-growth technique (critical cavity radius determination) to measure surface free energies is given.

44664 Reactive element effect studied using ion implantation. King, W.E. (Lawrence Livermore National Lab., CA (USA)); Grabowski, K.S. pp. 277-298 of Environmental degradiation of ion and laser beam treated surfaces. Was, G.S.; Grabowski, K.S. The Metallurgical Society Inc., Warrendale, PA (USA) (1989). DOE Contract W-7405-ENG-48. (CONF-880917–: Seminar on new approaches in practices and process technology for radiation sterilization of medical supplies, Laval (Canada), 25-29 Sep 1988).

Implantation of reactive elements into metals that form chromia layers upon exposure to high temperature oxidizing environments has a very large effect on the growth rate of the oxide and adhesion of the oxide to the base alloy. The authors have investigated the effect of Y ion implantation on the high temperature oxidation of Fe-24Cr using Rutherford backscattering spectroscopy, secondary ion mass spectroscopy, and electron microscopy. Analytical tools have been applied to determine the spatial distribution of Y, the microstructure of the oxide, and contribution of oxygen transport to the oxidation process. Results are compared with similar experiments in Fe-Cr alloys with Y additions and with results of cation and anion tracer diffusion experiments.

44665 Influences of crack closure and load history on near-threshold crack growth behavior in surface flaws. Jira, J.R. (Idaho National Engineering Laboratory, Idaho Falls (USA)); Nicholas, T.; Nagy, D.A. pp. 303-314 of Surface-crack growth: Models, experiments, and structures; Proceedings of the Symposium, Sparks, NV, Apr. 25, 1988. Reuter, W.G.; Underwood, J.H.; Newman, J.C. Jr. American Society for Testing and Materials, Philadelphia, PA (US) (1990). (CONF-8804331–: Surface-crack growth: models, experiments, and structures symposium, Sparks, NV (USA), 25 Apr 1988).

Fatigue crack growth threshold tests are conducted on a high-strength titanium alloy using a surface flaw specimen geometry. A laser interferometer is used to monitor crack-mouth opening diplacements, from which compliance determined crack length is computed. Four types of loading history, involving both increasing and decreasing stress-intensity range, are used to reach a threshold condition. Results from all four test types indicate that a single value of an effective stress-intensity range is obtained which is independent of stress ratio R or load history. Crack growth rate data in the near-threshold regime, on the other hand, appear to have dependence on R even when an effective stress-intensity range is used as a correlating parameter. 17 refs.

44666 Hyperconductivity in chilled beryllium metal. Mueller, F.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)); Johnson, K.A.; Medina, W.J.; Lewis, H.D.; Phillips, D.S.; Hundley, M.F.; Thompson, J.D.; Fisk, Z.; Jacobson, L.A.; Maggiore, C.J.; Smith, J.F.; Honig, E.M.; Gordon, W.L.; S *Applied Physics Letters (USA),* 57(3): 240-242 (16 Jul 1990).

It is shown that in the vicinity of 77 K beryllium has a superior specific conductance compared with the nominally excellent metallic conductors aluminum and copper. It is concluded that beryllium should be considered for some conduction applications, despite its well known toxicity problems.

44667 Chemical and reconstruction-induced surface core-level shifts: H on low-index W surfaces. Riffe, D.M. (AT&T Bell Laboratories, Murray Hill, NJ (USA)); Wertheim, G.K.; Citrin, P.H. *Physical Review Letters (USA),* 65(2): 219-222 (9 Jul 1990). DOE Contract AC02-76CH00016.

The H-induced shift of the surface-atom core-level binding energy in W(110) is shown to arise from two distinct effects, one chemical in nature and the other structural. The structural shift supports a recently proposed $(1p\times1)$ reconstruction that turns on at ~0.5 monolayer coverage. These new findings are used to provide a self-consistent interpretation of previously reported shifts from H-covered W(111) and W(100) surfaces.

44668 Nickel passivation in acidic chloride solution using optical second harmonic generation. Frye, J.M. (Argonne National Lab., IL (USA)); Schauer, M.W.; Pellin, M.J.; Gruen, D.M.; Melendres, C.A. *Chemistry of Materials (USA),* 2(3): 245-248 (May-Jun 1990). DOE Contract W-31-109-ENG-38.

Optical second harmonic generation (SHG), originating at the interface of a highly polished nickel electrode in acidified chloride (0.1 M NaCl, 0.01 M HCl) solution, has been observed. Striking changes in the SHG intensity were observed accompanying the onset of passive film formation, with incident light at wavelengths (λ_0) of 1,064 and 532 nm. Analyses of the SHG and cyclic voltammetry measurements lead to the following conclusions: (1) The existence of two peaks in the cyclic voltammogram (CV) at the $Ni^0 \rightarrow Ni^{2+}$ oxidation potential strongly suggests that passive film formation on polycrystalline nickel in this electrolite is a two-step process. (2) Actual film formation is concurrent with the second (more anodic) peak in the CV, as is evidenced by the dramatic change in SHG (λ_0 = 1,064 nm) observed at this potential. (3) The first peak appears to be due to dissolution.

44669 Damascus Steel-Part III: The Wadsworth-Sherby mechanism. Verhoeven, J.D. (Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Materials Science and Engineering); Baker, H.H.; Peterson, D.T.; Clark, H.F.; Yater, W.M. *Materials Characterization (USA),* 24(3): 205-227 (Apr 1990).

Several blades have been forged from a Fe-1.6 wt% C alloy after heat treating to form austenite grain boundary allotriomorph (GBA) cementite (Cm). This is the Wadsworth–Sherby technique proposed as the mechanism for forming the pattern on Damascus blades. Both the forging temperature and the severity of metal flow during forging were systematically varied. The patterns obtained are compared to a genuine Damascus sword and shown to be macroscopically somewhat similar, but microscopically quite different. It is concluded that the Wadsworth–Sherby technique is probably not the technique used by ancient blacksmiths to produce the Damask pattern in their blades.

44670 Magnetic-resonance exchange scattering at the iron L_{II} and L_{III} edges. Kao, C. (Brookhaven National Laboratory, Upton, NY (USA)); Hastings, J.B.; Johnson, E.D.; Siddons, D.P.; Smith, G.C.; Prinz, G.A. *Physical Review Letters (USA),* 65(3): 373-376 (16 Jul 1990). DOE Contract AC02-76CH00016.

Specular reflectivity of *p*-polarized light near the iron L_{II} and L_{III} absorption edges was measured from a single-crystal iron film with an external magnetic field perpendicular to the scattering plane. Large changes in reflectivity were observed upon reversal of the direction of the magnetic field. We attribute this resonant magnetization-sensitive effect to the interference between magnetic and nonmagnetic contribution to the resonant scattering. Similar effects can be expected in other ferromagnetic and ferrimagnetic systems.

44671 Investigation of the effects of boron on Ni_3Al grain boundaries by atomistic simulations. Chen, S.P. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)); Voter, A.F.; Albers, R.C.; Boring, A.M.; Hay, P.J. *Journal of Materials Research (USA),* 5(5): 955-970 (May 1990). DOE Contract W-7405-ENG-36.

A series of simulations has been performed on grain boundaries in Ni and Ni_3Al with and without boron doping using embedded atom-style potentials. A new procedure of obtaining "reference" data for boron related properties from electronic band structure calculations has been employed. Good agreement with existing experimental structural and energetic determinations was obtained. Boron is found to segregate more strongly to grain boundaries than to free surfaces. Adding boron to grain boundaries in Ni and Ni_3Al increases their cohesive strength and the work required to pull apart the boundary. This effect is much more dramatic for Ni-rich boundaries than for stoichiometric or Al-rich boundaries. In some Ni-rich cases, adding boron increases the cohesive strength of the boundary to such an extent that the boundaries become stronger than the bulk. Bulk Ni_3Al samples that are Ni-rich produce Ni-rich grain boundaries. The best cohesive properties of Ni_3Al grain boundaries are obtained when the boundary is Ni saturated and also with boron present. Boron and nickel are found to co-segregate to the grain boundaries.

44672 Temperature dependence of the amorphization of NiTi irradiated with Ni ions. Maziasz, P.J. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6376 (USA)); Pedraza, D.F.; Packan, N.H.; Simmons, J.P. *Journal of Materials Research (USA),* 5(5): 932-941 (May 1990). DOE Contract AC05-84OR21400.

NiTi was irradiated with Ni ions at various temperatures in order to study the temperature dependence of the irradiation-induced crystalline-to-amorphous transition. The irradiations were conducted above the A_f temperature, and thus the specimens contained only the ordered B2 (CsCl) phase. The irradiations to similar doses at 150, 200, and 250 °C showed that the amorphization kinetics slow down appreciably as the temperature is increased in this range. No amorphization was detected at irradiation temperatures of 350 °C or higher, even after doses of 4 dpa. The small volume fraction of amorphous material observed after irradiation to 0.67 dpa at 250 °C indicates that the cutoff temperature for amorphization is in the vicinity of this temperature. The amorphous regions of partly amorphous samples are distributed in a non-uniform manner and exhibit a morphology similar to the martensitic microstructure that existed in the specimens before heating to the irradiation temperature. Large amorphous regions in these samples exhibit some very fine crystalline debris which tends to disappear with increasing irradiation dose. Post-irradiation annealing experiments indicated that no thermally activated crystallization occurred during irradiation at temperatures up to 250 °C.

44673 Electronic, elastic, and fracture properties of trialuminide alloys: Al_3Sc and Al_3Ti. Fu, C.L. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6114 (USA)). *Journal of Materials Research (USA),* 5(5): 971-979 (May 1990). DOE Contract AC05-84OR21400.

The electronic mechanism behind the brittle fracture of trialumide alloys is investigated using the full-potential linearized augmented plane-wave (FLAPW) total-energy method within the local density functional approach. To this end, the bulk phase stability, the elastic constants, the anti-phase boundary (APB) energy, the superlattice intrinsic stacking fault (SISF) energy, and the cleavage energy on different crystallographic planes have been determined. A small energy difference (≈0.10 eV/unit formula) is found between the DO_{22} and $L1_2$ structures of Al_3Ti. In general, the trialuminide alloys have large elastic modulus, small Poisson's ratio, and small shear modulus to bulk modulus ratio. An extremely high APB energy (≈670 mJ/m^2) on the (111) plane is found for Al_3Sc, indicating that the separation between 1/2 ⟨110⟩ partials of a ⟨110⟩(111) superdislocation is small. Since the total superdislocation has to be nucleated essentially at the same time, a high critical stress factor for dislocation emission at the crack tip is suggested. The high APB energy on the (111) plane is attributed to the directional bonding of Sc(*d*-electron)–Al(*p*-electron). The same type of directional bonds is also found for Al_3Ti. In addition, moderately high values of SISF energy (≈265 mJ/m^2) on the (111) plane and APB energy (≈450 mJ/m^2) on the (100) plane are found for Al_3Sc. The brittle fracture of trialuminide alloys is attributed to the higher stacking fault energies and a lower cleavage strength compared to those of a ductile alloy (e.g., Ni_3Al). While the (110) surface has the highest surface energy, the cleavage strength (≈19 GPa) of Al_3Sc is found to be essentially independent of the crystallographic planes.

44674 Elastic interaction of hydrogen in palladium studied by molecular-dynamics simulation. Salomons, E. (Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, California 94720 (USA)). *Physical Review, B: Condensed Matter (USA),* 42(2): 1183-1188 (15 Jul 1990).

A simulation model for the palladium-hydrogen system is studied by Andersen's scheme of molecular dynamics in the isothermal-isobaric ensemble. Widom's particle-insertion method is used to determine the chemical potential of the hydrogen lattice gas. It is shown that Andersen's Lagrangian corresponds to a lattice with a free surface (although periodic boundary conditions are used), and in agreement with this the α-α' ("gas-liquid") phase transition of metal-hydrogen systems is reproduced by the simulation model. A value of 3.0 A^3 is found for the partial volume V_H of hydrogen in palladium, in almost exact agreement with experiment. Further, the thermodynamic Maxwell relation $(\partial\mu/\partial p)=V_H$ is confirmed by the simulations (i.e., classical mechanics). Finally, the effective elastic interaction of the hydrogen lattice gas is determined, and compared with the Wagner and Horner theory, which expresses this interaction in terms of phonon modes in the first Brillouin zone.

44675 Parametric studies of dynamic powder consolidation using a particle-level numerical model. Williamson, R.L. (Idaho National Engineering Laboratory, EG&G Idaho, Inc., P.O. Box 1625, Idaho Falls, Idaho 83415-2211 (USA)). *Journal of Applied Physics (USA),* 68(3): 1287-1296 (1 Aug 1990). DOE Contract AC07-76ID01570.

A numerical simulation approach is used to investigate various aspects of dynamic metal powder consolidation. A two-dimensional continuum model is employed where only a few powder particles, and the interparticle voids, are considered. Consolidation is achieved by introducing large compressive stress waves in type 304 stainless-steel powder material using a high-velocity flyer plate. The effects of stress-wave amplitude on the particle deformation, consolidation rate, and temperature field are discussed based on the results of simulations using projectile impact velocities of 0.5, 1.0, and 2.0 km/s. It is demonstrated that increases in stress-wave amplitude result in higher surface temperatures leading to more extensive interparticle bonding. The 0.5 km/s impact results in full densification but is insufficient to create particle melting and bonding; the 2.0 km/s impact results in extensive interparticle melting. The effects of simple variations in the initial particle geometry are investigated by considering monosized and bimodal particle distributions and a matrix of identical hollow particles. Because each of these simulations correspond to a different initial density, the results are used to examine the effects of initial void fraction on energy deposition in the powder material during consolidation. It is shown that the average internal energy of the consolidated particles increases substantially as the initial void fraction is increased. In a final simulation, argon is placed in the regions between particles to investigate the effects of interstitial gases on the temperature field during consolidation. Shock compression of the gas results in increased surface temperatures and more extensive interparticle melting; for the materials and consolidation conditions considered, however, it is not a predominant energy deposition mechanism.

44676 Propagating lattice instabilities in shock-loaded metals. Taylor, P.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (USA)); Dodson, B.W. *Physical Review, B: Condensed Matter (USA),* 42(2): 1200-1204 (15 Jul 1990). DOE Contract AC04-76DP00789.

The first atomic-scale simulations of shock propagation using accurate many-body atomic interactions have been performed. Shock propagation in copper was modeled with use of the embedded-atom method. Lattice instabilities, consisting of crystallographic twinning boundaries and martensitic regions, were observed to form and propagate behind the shock front for impact velocities as low as 0.01 km/sec. The twinning boundary dislocations cause a loss of shear strength, resulting in a significant reduction in shock-wave velocity, without the accompaniment of permanent crystallographic damage. This new mode of lattice deformation is qualitatively different from the behavior characteristic of pairwise atomic interactions.

44677 Electronic structure of NiAl. Lui, S. (Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104 (USA)); Davenport, J.W.; Plummer, E.W.; Zehner, D.M. *Physical Review, B: Condensed Matter (USA),* 42(3): 1582-1597 (15 Jul 1990). DOE Contract AC02-76CH00016.

The valence-band structure of nickel aluminum was measured by use of angle-resolved photoemission with synchrotron radiation and calculated using the local-density approximation. The overall agreement between theory and experiment is remarkably good—much better than for pure nickel. This means that the "self-energy" corrections are significantly less in NiAl than in pure nickel. The core-level binding energies in NiAl are compared experimentally and theoretically with the equivalent levels in Ni and Al. Surprisingly, the Ni core shifts to higher binding energy and the Al to lower as if charge were transferred from Ni to Al—opposite to the direction predicted from electronegativity. These observations are discussed in terms of bonding in NiAl.

44678 Role of the substrate in enhancing the magneto-optic response of ultrathin films: Fe on Au. Moog, E.R. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Bader, S.D.; Zak, J. *Applied Physics Letters (USA),* 56(26): 2687-2689 (25 Jun 1990). DOE Contract W-31109-ENG-38.

Simulations are presented for the magneto-optic rotation and ellipticity as a function of Fe thickness in the 0–400 A range for the

system Fe on Au (100). The results, which are based on tabulated bulk optical constants, agree with recent experiments and explicitly demonstrate the role of the Au underlayer in enhancing the signal from the ferromagnetic overlayer.

44679 Void formation in pulsed laser induced via/contact hole filling. Marella, P.F. (Solid-State Electronics Laboratory, Stanford University, California 94305 (USA)); Tuckerman, D.B.; Pease, R.F. *Applied Physics Letters (USA)*, 56(26): 2625-2627 (25 Jun 1990).

Metal (Au, Cu, and Al-1% Cu) layers sputter deposited over vias and contact holes of varying diameter and aspect ratio are melted and planarized by irradiation with either a 600 ns pulse duration flashlamp-pumped dye laser or a 35 ns pulse duration excimer laser. High aspect ratio ($\gtrsim$1) vias and contact holes yield metal profiles that suffer from void formation during the laser-induced flow. This void formation is explained by considering surface tension forces that, in high aspect ratio cases, act to close off the top of a hole without filling it.

44680 Low-energy electron diffraction intensity analysis of the atomic geometry of $p(1\times1)$ monolayers of bismuth on GaAs(110). Duke, C.B. (Pacific Northwest Laboratory, Richland, Washington 99352 (USA)); Lessor, D.L.; Guo, T.; Ford, W.K. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3412-3416 (Jul 1990). DOE Contract AC06-76RL01830.

The elastic low-energy electron diffraction intensities of 18 diffracted beams associated with electrons normally incident on GaAs(110)-$p(1\times1)$–Bi(1 ML) (monolayer) have been measured at 130 K. Analysis of these beams using a multiple scattering methodology previously applied to GaAs(110) and GaAs(110)-$p(1\times1)$–Sb(1 ML) yields a best-fit structure characterized by a bond-length-conserving top layer rotation of chains of Bi atoms by a tilt angle of $\omega_1 = 3° \pm 2°$ and a counter rotation (Ga displaced outward toward the Bi overlayer) in the underlying GaAs(110) layer of $\omega_2 = -3° \pm 2°$. A small contraction of the top-layer spacing is possible but is not mandated by the analysis. Only geometries analogous to that of GaAs(110)-$p(1\times1)$–Sb(1 ML) were included in the structural search.

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Refer also to citation(s) 43653, 43663, 44491, 44559, 44592, 44636, 44647, 44660, 44795, 44814, 44820, 44887, 44934, 45007, 45024, 45026, 45030, 45060, 45156, 45719, 46083

44681 (AD-A–220912/0/XAB) **Mechanical properties of beta-silicon nitride whisker/silicon nitride matrix composites.** Neergaard, L.J.; Homeny, J. Illinois Univ., Urbana, IL (USA). 1989. 9p. Source: NTIS, PC A02/MF A01.

Pub. in Ceramic Engineering Science Procedures, Vol. 10(9-10), 1049-1062(1989).

Whisker-reinforced ceramic matrix composites have received a great deal of attention for applications as high temperature structural materials in, for example, advanced heat engines and high temperature energy conversion systems. Fo: these applications, where mechanical reliability is critical, the improvements that can be realized in fracture stress and fracture toughness by the addition of whiskers to polycrystalline ceramics are of great interest. The primary role of the whisker reinforcement is to prevent catastrophic brittle failure by activating mechanisms that dissipate energy during crack propagation. Relevant toughening mechanisms include whisker bridging, whisker pullout, crack deflection, and microcrack formation. Of particular importance for optimizing the mechanical reliability of these composites is the effect of the whisker/matrix interfacial characteristics on these toughening mechanisms.

44682 (AD-A–220928/6/XAB) **Silicon carbide whisker/alumina matrix composites: Effect of whisker surface treatment on fracture toughness.** Homeny, J.; Vaughn, W.L.; Ferber, M.K. Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering. Feb 1990. 10p. Source: NTIS, PC A02/MF A01.

Pub. in Jnl. of the American Ceramic Society, Vol. 73, No. 2, 394-402(Feb 1990).

In ceramic matrix composites, whisker reinforcements are primarily utilized to enhance the fracture toughness of the composite. Essentially, the whisker reinforcement prevents catastrophic brittle failure by providing processes that dissipate energy during the fracture process. The operation of various toughening mechanisms, such as crack deflection, whisker pullout, and whisker bridging, to a large extent depends on the nature of the whisker/matrix interface. Several factors affect the whisker/matrix interface, including matrix chemistry, whisker surface chemistry, whisker morphology, and thermal expansion mismatches.

44683 (AD-A–221756/0/XAB) **Self-lubricating-diamond like coatings deposition. Final report, 20 November 1986-28 March 1989.** Hirvonen, J.; Halverson, W. Spire Corp., Bedford, MA (USA). Dec 1989. 52p. (FR–10102). Source: NTIS, PC A04/MF A01.

Ion beam enhanced deposition (IBED) has been used to deposit hard, adherent thin films of boron nitride with a significant cubic crystal structure present. A number of analytical techniques have been used to characterize these coatings including X-ray photoelectron spectroscopy (XPS); X-ray diffraction (XRD); transmission electron microscopy (TEM); Raman spectroscopy; nuclear radiation analysis (NRA); Rutherford Backscattering spectroscopy (RBS); and IR spectroscopy. Friction and wear behavior of these coatings was also conducted. The IBED-i-BN thin films generally exhibit a high microhardness and good adhesion to the silicon and 304 stainless steel substrates. All films (except one) had the hyperstoichiometric boron concentration. The ration Boron/Nitride approached the theoretical value at the highest current densities of the nitrogen beam. Many of the i-BN coatings exhibited low friction against 440 C stainless steel and Silicon nitride counterfaces. Friction seems to increase with increasing B/N ratios. There is a strong demand for diamond-like coatings of boron nitride (BN) in a large number of tribological applications including cryogenic bearings and adiabatic engines. Commercial use of BN coatings has previously been impeded by sample to sample reproducibility problems which have been overcome by the innovative Spire process using ion beam enhanced deposition (IBED).

44684 (AD-A–221867/5/XAB) **Interfacial studies of chemical-vapor-infiltrated (CVI) ceramic matrix composites. Final report.** Brennan, J.J. United Technologies Research Center, East Hartford, CT (USA). 31 Mar 1990. 67p. (UTRC/R–90-917779-5). Source: NTIS, PC A04/MF A01.

The objective of this program was to investigate the fiber/matrix interfacial chemistry in CVI SiC matrix composites utilizing Nicalon SiC and Nextel 440 mullite fibers and to determine how this interface influences composite properties such as strength, toughness, and environmental stability. The SiC matrix was deposited using three different reactants; methyldichlorosilane (MDS), methyltrichlorosilane (MTS), and dimethyldichlorosilane (DMDS). The fiber/matrix interface was tailored by means of introducing a carbon, BN, or carbon rich SiC interfacial layer. It was found that applying a carbon interfacial layer to either NICALON or Nextel 440 fibers prior to deposition of SiC resulted in a weakly bonded interface that imparted toughness to CVI matrix composite through its ability to deflect matrix cracks. This carbon layer can be applied either deliberately by the decomposition of methane or by utilizing an argon flushing gas in the reactor that apparently interrupted the normal deposition of SiC from silane precursors and instead allowed carbon to deposit. It was found that this carbon interfacial layer, no matter how it was deposited, was not oxidatively stable at elevated temperatures, leading to severe degradation of composite properties.

44685 (BNL–44819) **μSR and high T_c superconductivity.** Emery, V.J. Brookhaven National Lab., Upton, NY (USA). [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900489–2: 5. international conference on muon spin rotation, relaxation and resonance, Oxford (UK), 9-12 Apr 1990). Order Number DE90015089. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Some implications of μSR experiments on high temperature superconductors are discussed. The possible relationship between the observation of spin freezing and the tendency of mobile holes to phase separate is considered. Measurements of the magnetic penetration depth as a function of doping are shown to imply that a

non-retarded, or high energy scale pairing interaction is responsible for high temperature superconductivity. The depression of the transition temperature at high doping is associated with a crossover away from the regime in which a charge-transfer gap is relevant. 21 refs.

44686 (CEA-R-5517) **Study of the electronic structure modifications of silicon oxide (α -SiO_2), aluminium oxide (α -Al_2O_3) and yttrium oxide (Y_2O_3), induced by structure defects (non-stoichiometry, mechanical stresses, heavy ion irradiation).** Jollet, F. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Paris-6 Univ., 75 (France). Oct 1989. 196p. (In French). Order Number DE90514565. Source: NTIS (US Sales Only), PC A09/MF A01.

We have studied ceramics, experimentally (X-ray threshold absorption, photoelectron spectroscopy) and theoretically (density of states calculations based on a tight-binding method). Three ways have been followed: - influence of oxygen stoichiometry on the electronic structure of Y_2O_3: we have showed the splitting of the yttrium d-orbitals (octahedral symetry site), the splitting of the K-yttrium threshold (band effect), and the splitting of the K-oxygen threshold (hybridization of the oxygen p-levels with the yttrium p and d levels in the conduction band). For the valence band, the importance of O-O interactions have been underlined. The introduction of oxygen vacancies makes the Y-O bond more covalent, so that samples are more conductive and their optical dielectric constant increases. - effect of a mechanical stress on the electronic structure of quartz (α -SiO_2): - influence of a heavy ion irradiation on the electronic structure of quartz and alumina: After irradiation, quartz is in a desorganized crystalline state, different from an amorphous state. Results have been interpreted in terms of metamict state and internal mechanical stresses.

44687 (CONF-901009–3) **Wear of advanced ceramics: An overview.** Yust, C.S. Oak Ridge National Lab., TN (USA). [1990]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Japan international tribology conference; Nagoya (Japan); 29 Oct - 1 nov 1990. Order Number DE90012166. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many new ceramic compositions and microstructures with improved mechanical properties have been recently developed. These advanced ceramics are of great interest as wear-resistant materials. Fundamental studies are in progress in support of such applications on many monolithic ceramics as well as complex microstructures derived from combinations of two or more of them. Fundamental studies often involve short duration. Unlubricated wear tests even though lubrication and long-term durability is a service requirement. Some results of current wear studies of monolithic and composite ceramics are reviewed ad discussed in this paper. 39 refs., 2 figs.

44688 (CONF-901071–2) **Adhesion of silver films to ion-bombarded zirconia.** Erck, R.A.; Fenske, G.R. Argonne National Lab., IL (USA). Feb 1990. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990. Order Number DE90010088. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effects of ion bombardment on thin film adhesion are not well understood for many metal-ceramic systems. Electron-beam-evaporated silver films were deposited on zirconia substrates either directly on the sputter-cleaned substrate or with the use of a bonding interlayer, and film adhesion was measured with a pull-type tester. Argon- and argon/oxygen-ion presputtering produced large increases in adhesion strength, the greatest occurring for the oxygen-ion assist. Deposition of a reactive Cr or Ti intermediate layer also produced large adhesion increases, with Cr the most effective. 19 refs., 3 figs., 1 tab.

44689 (CONF-901071–3) **Ion-beam-assisted deposition of silver films on zirconia ceramics for improved tribological behavior.** Erdemir, A.; Busch, D.E.; Erck, R.A.; Fenske, G.R.; Lee, R. Argonne National Lab., IL (USA). [1990]. 39p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990. Order Number DE90009706. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Silver coatings of 2 μm nominal thickness were deposited on toughened zirconia ceramics by ion-beam-assisted deposition (IBAD). Tribotests were performed with ball-on-disk machines under a load of 5 N, at velocities of 0.1 to 2 $m.s^{-1}$, and in dry and normal air. The sliding friction coefficients of zirconia on itself ranged from 0.3 to 1.2, and the wear rates spanned more than three orders of magnitude, depending on the sliding velocity. In contrast, the wear of IBAD-silver-coated disks was practically unmeasurable, and the wear of zirconia balls was reduced by factors of 5 to 1200 below that of balls slid against uncoated zirconia disks. Large reductions in friction coefficients were also observed for the pairs that included an IBAD-silver film. Scanning-electron microscopy and laser-Raman spectroscopy were used to elucidate the mechanisms of wear of coated and uncoated ceramics. 28 refs., 11 figs., 2 tabs.

44690 (CONF-901071–7) **The friction and wear of lubricated Si_3N_4/SiC(w) composites.** Yust, C.S.; DeVore, C.E. Oak Ridge National Lab., TN (USA). [1990]. 25p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990. Order Number DE90015790. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The friction and wear of a 20 vol % silicon carbide whisker-silicon nitride matrix composite was measured at room temperature in both lubricated and unlubricated sliding. A pin-on-desk test configuration was used in which the pin member was a 9.53-mm-dia sphere. Silicon carbide and silicon nitride spheres were tested against the composite in both unidirectional and reciprocating sliding. The range of experimental parameters included normal forces from 1 to 45 N, velocities of 0.1 and 0.3 m/s, and test durations of 5 min to 3 h. The lubricant used in the room temperature tests was a commercial synthetic, fully formulated engine oil (5W30). In unlubricated sliding, silicon nitride produced more severe wear of the composite than did silicon carbide. In lubricated sliding, very little wear occurs in either sliding pair at even the longest test exposure. The data are presented in "wear space" co-ordinates and this form of presentation is compared to other wear mechanism map concepts presently in use. 10 refs., 9 figs.

44691 (CONF-901073–2) **Oxidation of copper and electronic transport in copper oxides.** Park, J.-H.; Natesan, K. Argonne National Lab., IL (USA). Apr 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 178. meeting of Electrochemical Society, Inc.; Seattle, WA (USA); 14-19 Oct 1990. Order Number DE90011179. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Oxidation of copper and electronic transport in thermally grown and large grain crystals of nonstoichiometric copper oxides were studied at elevated temperatures. Thermogravimetric copper oxidation studies were performed in air at the temperatures between 350 and 1000°C. Electronic behavior of nonstoichiometric Cu_2O indicates that a doubly charged oxygen interstitial and electron holes are the charge defects in the material. 1 ref., 4 figs.

44692 (CONF-9009222–1) **The [H-Ca$^+$] defect in thermochemically reduced CaO: Static and dynamical EPR [electron paramagnetic resonance] study.** Orera, V.M. (Zaragoza Univ. (Spain). Inst. de Ciencia de los Materiales de Aragon); Sanjuan, M.L.; Chen, Y. Oak Ridge National Lab., TN (USA). [1990]. 3p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Lattice defects in insulating materials conference; Groningen (Netherlands); 3-7 Sep 1990. Order Number DE90014454. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The role of hydrogen impurities in modifying the optical properties of thermochemically reduced (TCR) MgO and CaO, has been the subject of an extensive work in the last years. Several hydrogen related electron traps have been identified in MgO using electron paramagnetic resonance (EPR) and optical absorption techniques. 7 refs.

44693 (ENEA-RTI-TIB–89-19) **C.A.R.S. diagnostics on ceramic powder photosynthesis reactor.** Belardinelli, R.; Bijnen, F.; Cenciarelli, I.; Fantoni, R.; Piccirillo, S.; Schina, G. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1989. 50p. (In Italian). (RTI/TIB–89-19). Order Number DE90514522. Source: NTIS (US Sales Only), PC A03.

This paper describes the Coherent Anti-Stokes Raman Scattering, C.A.R.S., diagnostic technique for molecules (i.e., silane, ammonia, hydrocarbons) used as reactants in the photosynthesis of ultrafine ceramic powders. Attention is given to a 10 m optical line developed for the transport, within the reactor, of the two laser beams used in the diagnostics and the line for the collection and separation of the Anti-Stokes beam generated on the reaction flame. First results show that C.A.R.S. spectroscopy effectuated with a wide band coloured laser, is an on-line technique which permits the control, in real time, of the temperature and concentration of the molecules present in the reactor during powder production. Measurements taken in different points of the flame evidence good spatial resolution. The identification of low stability reaction intermediates indicates the method's sensitivity, above all, in the case of resonant C.A.R.S. schemes.

44694 (KEK–89-19, pp. 88-90) **Unsolved problems in high Tc superconductor related compounds: For the fruitful collaboration between UK and Japan neutron scattering project.** Yamada, Kazuyoshi (Tohoku Univ., Sendai (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2. workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

This report present several problems in the high Tc superconductor related compounds with isolated antiferromagnetic layer such as La_2MO_4 and Nd_2MO_4 where M denotes 3d transition metal atom. These problems have been left unsolved because these are rather fundamental and difficult to solve in a short period under the competition among the high Tc superconductivity studies. Among them however, one could find out essential clue to elucidate the mechanism of the superconductivity or to establish the fundamental concept for the low dimensional magnetism. Also I believe there are several suitable measurements for UK-Japan neutron scattering project. (author).

44695 (LBL–28669) **Experimental and theoretical characterization of the $YBa_2Cu_3O_7$/$YBa_2Cu_4O_8$ phase transformation.** Fendorf, M. (Lawrence Berkeley Lab., CA (USA)); Burmester, C.P.; Gronsky, R.; Wille, L.T. Lawrence Berkeley Lab., CA (USA). Jul 1990. 8p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Grant MDA972-88-J-1002. (CONF-900577–1: Symposium on surface processing and laser assisted chemistry in conjunction with the spring meeting of the European Materials Research Society, Strasbourg (France), 29 May - 1 jun 1990). Order Number DE90015309. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The $YBa_2Cu_4O_8$ to $YBa_2Cu_3O_7$ transformation in mixed phase, superconducting YBaCuO is investigated by high resolution transmission electron microscopy and static lattice, three dimensional, Monte Carlo computer simulations. Micrographs reveal dislocations and stacking faults associated with the transformation that are accurately predicted by the calculations and seen in "snapshots" of the simulated structures. An atomic mechanism involving the intercalation of extra CuO planes by partial dislocation climb is proposed for the $YBa_2Cu_4O_8$/$YBa_2Cu_3O_7$ phase change. 19 refs., 5 figs.

44696 (LBL–28993) **A correlation between T_3 and electronegativity difference in high-temperature superconductors.** Jou, C.J. (Ecole Polytechnique, 91 - Palaiseau (France)); Washburn, J. Lawrence Berkeley Lab., CA (USA). Apr 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016640. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For compound superconductors a correlation is found between superconducting critical temperature. $T_c \geq$ 10K and difference in Pauling's electronegativity, ΔN, between certain elements in the structure. For all the high-$T_c$oxide layer-structure compounds, $T_c$increases linearly with ΔN with the $T_c$corresponding to the extrapolation to ΔN=0 being ~30K. For all others, the more three-dimensional structures, $T_c$also appears to be related to ΔN but forms a completely separate correlation curve at lower values of T_c. 18 refs., 1 fig., 1 tab.

44697 (LBL–29216) **Oxygen ordered superstructures and domain formation in $YBa_2Cu_3O_{7-x}$.** Wille, L.T. (Florida Atlantic Univ., Boca Raton, FL (USA). Dept. of Physics); Burmester, C.P.; Gronsky, R.; Sterne, P.A.; Ahn, B.T.; Lee, V.Y.; Beyers, R.; Guer, T.M.; Huggins, R.A. Lawrence Berkeley Lab., CA (USA). May 1990. 6p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098 ;W-7405-ENG-48. Grant MDA 972-88-J-1006. (CONF-900527–3: ICMC '90 topical symposium on high temperature superconductors: materials aspects, Garmisch-Partenkirchen (Germany, F.R.), 9-11 May 1990). Order Number DE90015633. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In spite of a good deal of recent effort, the thermodynamic stability and kinetics of formation of ordered O–Cu–O chains in the basal plane of $YBa_2Cu_3O_{7-x}$ remain unclear. Because the chain disordering is associated with the orthorhombic-to-tetragonal phase transformation and the ensuing loss of superconductivity, a fundamental understanding of the nature of the oxygen-vacancy ordering has far-reaching implications for materials preparation and optimization. In order to clarify some of these questions, we have undertaken a combined theoretical (first-principles) and experimental (HREM) study of the thermodynamic properties of the $YBa_2Cu_3O_{7-x}$ system. 28 refs., 3 figs.

44698 (PB–90-873639/XAB) **Ceramic bearings. January 1988-May 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for January 1988-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 57p. Source: NTISPC N01/MF N01.

Supersedes PB–89-852529; U.S. sales only.

This bibliography contains citations concerning the manufacturing techniques and applications of ceramic bearings. Topics include a discussion of materials, such as silicon nitride, and ceramic bearings in high speed and high temperature applications. An analysis of surface hardening techniques for wear and fatigue resistance is also included. (This updated bibliography contains 111 citations, 24 of which are new entries to the previous edition.)

44699 (SAND–90-0645) **A viscoelastic material model for computing stresses in glass.** Chambers, R.S. Sandia National Labs., Albuquerque, NM (USA). Jul 1990. 70p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90014851. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Glass-to-metal seals are an integral part of many electronic components. When seals are formed at elevated temperatures and cooled to room temperature, residual stresses are generated by the unequal thermal contractions of the constituent materials. The combination of high stress and low fracture resistance of glass makes it extremely difficult to design and build hermetic glass-to-metal seals. Rigorous and robust stress analyses must incorporate the complex and coupled changes in volumetric strain and stress relaxation which occur as glass passes through the liquid/solid temperature regime. The phenomenological behavior of glass can be modeled viscoelastically. The theory and numerical discretization of the viscoelastic equations is presented for use in finite element programs. Vectorizable integration schemes are derived for both the traditional hereditary integrals of viscoelasticity and the equivalent rate forms of the equations. The general behavior of glass is discussed and related to the viscoelastic model. Solutions to discretized viscoelastic equations are applied to an example problem and compared to results obtained from experimental data. The viscoelastic model of glass provides a new capability to analyze and design actual manufacturing processes by predicting, a priori, the effects of temperature history on the residual stress state.

44700 (SAND–90-1639C) **Processing of nanocrystalline ceramics.** Ciftcioglu, M. (New Mexico Univ., Albuquerque, NM (USA). Center for Micro-Engineered Ceramics); Mayo, M.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 10p. Sponsored by

U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900466–78: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90015700. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Methods of preparing non-agglomerated powders for three systems – yttria, titania, and yttria-stabilized zirconia – are reviewed. The non-agglomerated nature of these powders should make it possible to sinter them into dense ceramic bodies with nanocrystalline grain sizes. Experiments with yttria-stabilized zirconia have shown that this is indeed the case, with mean linear intercept grain sizes of 60 nm resulting from original powder particle diameters of 13 nm. This ultrafine-grained zirconia is shown, in turn, to have superplastic forming rates 34 times faster than a 0.3 μm-grained commercial zirconia of the same composition. 7 refs., 9 figs.

44701 (UCRL–94136) **Solid combustion synthesis of refractory materials.** Holt, J.B. Lawrence Livermore National Lab., CA (USA). 20 Feb 1986. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8503301–1: Industrial briefing to Bechtel/LLNL consortium, Livermore, CA (USA), 26 Mar 1985). Order Number DE90015362. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Combustion Synthesis takes advantage of the heat evolved during the chemical reaction between mixtures of solids or solids and gases. The quantity of heat released varies widely according to the particular chemical system. If the reaction is carried out in the combustion mode, then the product is raised to a high temperature by a rapidly moving combustion wave. This simple concept is the basis of a new low-cost approach to the synthesis of many refractory materials. The unique characteristics of this combustion process are the high temperatures (2000–3500°C) that are generated without the use of external energy, the rapidly moving combustion wave (0.1–10 cm/s), the high rate of heating at the combustion front (10^4–10^6°C/s) and volatilization of cation imparties at the combustion front. Our research clearly demonstrates that the Solid Combustion Process has potential as a method to synthesize many high-quality refractory materials by cost-effective methods.

44702 (UCRL–102335) **First principles calculation of oxygen ordering in $YBa_2Cu_3O_{7-y}$.** Sterne, P.A. (Lawrence Livermore National Lab., CA (USA)); Wille, L.T. Lawrence Livermore National Lab., CA (USA). 17 Apr 1990. 8p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Grant MDA-972-88-J-1006. (CONF-900466–76: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90015205. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have performed a number of first principles electronic structure calculations for $YBa_2Cu_3O_{7-y}$ with different oxygen orderings and concentrations. The resulting total energies have been used to assess the applicability of some of the proposed models for oxygen ordering in this system. We find that the results are consistent with an Ising-like model with asymmetric next-neighbor interactions between oxygen sites. We determine effective interaction parameters from the first principles calculations and use them to compute the phase diagram for the system, which is in excellent agreement with experiment. 17 refs., 2 figs.

44703 (UM-P–89/54) **Microstructure of lead zirconium titanate (PZT) by electron microscopy.** Bursill, L.A. (Melbourne Univ., Parkville (Australia). School of Physics); Peng JuLin; Sellar, J.R. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 5p. Order Number DE90636598. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Transmission and high-resolution electron microscopy reveal the microtexture of lead zirconium titanate ceramics. Fine scale ($\leq$ 500 Aangstroem) ferroelastic and ferroelectric twin domains, as well as dislocations were found in a complex texture. Correlations between stoichiometry, microstructure and piezoelectric properties are discussed. 6 refs., 3 figs.

44704 (UM-P–89/97) **Some crystal chemistry of $(Ln,Ce)_2CuO_{4-\delta}$ superconductors.** Goodman, P. (Melbourne Univ., Parkville (Australia). School of Physics); Keating, A.; Myhra, S.; White, T.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 29p. Order Number DE90636599. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Compounds of the form $(Ln, Sr, Ce)_2CuO_{4-\delta}$ (Ln = rare earth element) crystallise as the Nd_2CuO_4 structure type, K_2NiF_4 structure type or perfectly and imperfectly ordered intergrowths of these parent structures. These structurally similar phases exhibit superconductivity in which the charge carriers are holes (in Sr-doped material) or electrons (in Ce doped material). In this study, X-ray Photoelectron Spectroscopy (XPS) and High Resolution Electron Microscopy (HREM) were used to investigate the charge balancing mechanisms operating in each superconducting regime and the structural changes accompanying compositional variation. It was found that under slightly reducing conditions charge coupled cation substitutions predominate, whilst at low pO_2 ($<10^{-5}$ atm) perfectly ordered oxygen superlattices form. The structural and electronic changes which accompany deoxygenation were observed in situ during XPS and HREM observations. 29 refs., 8 figs., 3 tabs.

44705 Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. 1578p. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Papers on the use of ceramic materials for engines are presented, covering topics such as processing techniques for powders and composites, the rheological aspects of processing, processing nitride and carbide systems, joining and coatings, the mechanical properties of various ceramics, thermal and mechanical behavior, creep and fatigue behavior, toughened materials, nondestructive evaluation, machining and wear, and engine components. Specific topics include the characterization of Si_3N_4 powder for injection molding, zircon/zirconia structural ceramic materials for engine applications, SiC whiskers, part distortion for binder removal, undoped and low-doped Si_3N_4 with whisker reinforcement, gas pressure combustion sintering of TiB2-based composites, ZrC-BN coating for the thermal protection of C-C composites, colloidal processing of Si_3N_4 ceramics, the transient thermoelastic fracture analysis of ceramic-to-metal bonds, Ti-vapor-coated Si_3N_4 braze joints, diesel engine combustion and the rupture strength of partially-stabilized zirconia, and thermal shock resistance characterization of cellular alumina ceramics. Other topics include determination of K(Ic) values, high temperature cavitation of HIP Si_3N_4, the creep behavior of yttria- and alumina-doped SiN, biaxial static fatigue of Si_3N_4, proton NMR as a characterization method for polymeric binders in Si_3N_4, and the use of Si_3N_4 in gas engine applications.

44706 In situ Raman characterization of materials at high temperatures and pressures. Exarhos, G.J. (Pacific Northwest Lab., Richland, WA (USA)). pp. 3, Paper I & EC 2 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The availability of pulsed laser excitation sources and intensified gated array detectors allows phase identification and stability in ceramic materials to be probed in real time by Raman spectroscopy while the material is exposed to an applied stress (heat, compression, reactive environment). The utility of Raman spectroscopy for in situ probing of materials exposed to extreme environments will be presented in this review. Specific applications to be discussed include the response of boron nitride to temperatures approaching 2,400°K, and temperature and pressure-induced phase transformations in titania. The application of fiber optics for remote characterization of materials by Raman scattering will also be presented.

44707 Impurities in ceramics: Processing and effects on properties. Morris, P.A. (Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Central Research and Development Dept.). pp. 50-85 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

This paper reports that ceramic materials typically contain at least several thousand ppm of impurities. These impurities are present due to chemical inhomogeneities in the starting powdered materials or they are introduced during processing. In recent years, work has focused on understanding the effects that trace levels of impurities have on processes and properties in ceramics. To investigate these effects, procedures for characterization and clean-room processing have been developed. Experimental evidence is presented that shows the types of effects that impurities can have on grain boundary structures and microstructure development. Impurity effects on other properties, such as electrical and optical, are also discussed.

44708 Lead based $Pb(B_1B_2)O_3$ relaxors vs $BaTiO_3$ dielectrics for multilayer capacitors. Shrout, T.R. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Dougherty, J.P. pp. 3-19 of Ceramic dielectrics: Composition, processing and properties. Volume 8. Ling, H.C.; Yan, M.F. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-890421–: 91. annual meeting of the American Ceramic Society, Indianapolis, IN (USA), 23-27 Apr 1989).

Historically, $BaTiO_3$-based dielectrics have been the material of choice for multilayer capacitors (MLCs). Recently, compositions in the perovskite family having the general formula $Pb(B_1B_2)O_3$, known as relaxor ferroelectrics, have generated considerable interest. Their high dielectric constants, broad maxima, low E-field dependency, and low firing temperatures, as compared to conventional $BaTiO_3$-based dielectrics, make them attractive materials for MLCs. However, the complexities involved in the fabrication of MLCs makes it difficult to accurately compare the two families of dielectrics. In order to help in this comparison, the results from a questionnaire addressing the various issues of MLC manufacturing was prepared. The status of relaxors and how they stack up against the well established $BaTiO_3$ dielectrics are discussed.

44709 X-ray photoelectron spectroscopy of electronic ceramic materials: Complex chromites and manganites. Pederson, L.R. (Pacific Northwest Lab., Richland, WA (US)); Dake, L.S. pp. 43-54 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

X-ray photoelectron spectroscopy (XPS) has been used to probe valency in substituted perovskite oxides of the general formula ABO_3, including $(La,Sr)CrO_3$, $(Y,Ca)CrO_3$, and $(Y,Ca)MnO_3$. When Sr was substituted for La or when Ca was substituted for Y in the chromite series, a second Cr $2p_{3/2}$ peak appeared 3-4 eV higher in binding energy than the principal peak, consistent with oxidation of Cr^{3+} to Cr^{4+} and with previously proposed conduction mechanisms involving a highly localized electron hole (small polaron). Similar substitutions in the manganite series gave no observable energy shifts in the Mn 2p peak and negligible satellite intensity. For the manganites, a highly localized electron hole on an Mn site does not appear to be formed. Rather, results indicate a higher degree of covalency than found in the chromites.

44710 Electronic structure and conductivity of AL_2O_3. Blum, J.B. (Norton Co., Northboro, MA (USA)). pp. 111-134 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

The authors focus on the high temperature conductivity of Al_2O_3. Conductivity has traditionally been a sensitive probe of a material's defect chemistry. The results of the conductivity studies in Al_2O_3 have been disappointing because no consistent picture of the defect chemistry has been developed. The authors develop a fundamental material property of Al_2O_3, the high-temperature intrinsic electronic conductivity from first principles theoretical calculations and independent spectroscopic measurements. This can provide an independent estimate to compare with both the experimental conductivity data and defect chemistry models. They highlight, through an analysis of the current results, the conductivity studies which are consistent with the intrinsic electronic conductivity of single crystal Al_2O_3. The authors' work on the terms determining the intrinsic electronic conductivity of Al_2O_3, is ongoing, and this paper provides an interim view of their work.

44711 Thermal analysis and x-ray diffraction studies of the high temperature phase transformation in $PbTiO_3$ single crystals. Suchicital, C.T.A. (Dept. of Materials Science and Engineering, Univ. of Illinois at Urbana-Champaign, Urbana, IL (US)); Payne, D.A. pp. 169-174 of Ceramic dielectrics: Composition, processing and properties. Volume 8. Ling, H.C.; Yan, M.F. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-890421–: 91. annual meeting of the American Ceramic Society, Indianapolis, IN (USA), 23-27 Apr 1989).

Large isometric crystals of $PbTiO_3$ were grown from a low melting point flux. Data are reported for the thermal analysis and x-ray diffraction behavior on heating through the Curie point. Values are reported for the thermal hysteresis, enthalpy of transformation, and energy loss.

44712 Sintering kinetics and properties of lead magnesium niobate. Constantino, S.A. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Dayton, G.O.; Biggers, J.V. pp. 123-135 of Ceramic dielectrics: Composition, processing and properties. Volume 8. Ling, H.C.; Yan, M.F. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-890421–: 91. annual meeting of the American Ceramic Society, Indianapolis, IN (USA), 23-27 Apr 1989).

A controlled-profile sintering technique has been employed to examine the rapid sintering kinetics of pure PMN. Complications due to PbO volatilization were avoided by sintering in mechanically sealed platinum envelopes. High densities (97%) were achieved at temperatures as low 1000°C. Variations in heating rates showed no discernible effect on densification. However, a strong dependency of sintering kinetics on moderate modification in initial particle size was displayed, with densification rates increasing rapidly with decreasing size. The effect of thermal history on dielectric constant was investigated, and it is demonstrated that values increase with soak time for fully densified samples of similar grain size.

44713 Radiation-induced interface traps. Winokur, P.S. (Sandia National Lab., Albuquerque, NM (US)). pp. 193-255 of Ionizing radiation effects in MOS devices and circuits. Ma, T.P.; Dressendorfer, P.V. John Wiley and Sons Inc., New York, NY (USA) (1989).

When silicon is thermally oxidized, the interface between the amorphous oxide and the crystalline silicon is generally deficient of oxygen (or abundant in Si), giving rise to strained as well as uncompleted, or dangling, silicon bonds. These dangling bonds act as interface traps with energy levels within the forbidden bandgap at the SiO_2/Si interface. Today's high-quality, as-processed MOS devices have preirradiation interface-trap densities in the range of 10^9–10^{10} traps/cm^2. However, this value is extremely dependent on the details of processing, i.e., starting material, oxidation temperature, anneals, etc. When MOS samples are exposed to ionizing radiation, additional interface traps can be generated at the SiO_2/Si interface. These radiation-induced interface traps are the subject of this chapter.

44714 Characterization of materials using SIMS image depth profiling. Novak, S.W. (Charles Evans and Associates, Redwood City, CA (US)); Kanber, H.; Lowden, R. pp. 102-111 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

The SIMS image depth profiling technique consists of sequentially recording ion images as a sample is sputtered. Once recorded, the imaged volume can be examined sequentially, as cross sectional ion images, or as a selected area depth profile. The use of a conductive metal coating and electron bombardment during sputtering compensate for sample charging, allowing relatively insulating ceramic materials to be examined by this technique. Lateral resolutions of ion images is typically 1 μm whereas the depth resolution can be as low as 5-10 nm. The authors demonstrate the use of this SIMS technique to characterize disordering of GaAs/A1As heterostructures, Ti diffusion in $LiNbO_3$, and fiber-matrix interfaces in SiC-fiber reinforced SiC composites.

44715 The application of Rutherford backscattering and channeling techniques to the characterization of ceramics. Boatner, L.A. (Oak Ridge National Lab., Solid State Div., Oak Ridge, TN (US)); White, C.W. pp. 112-130 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). DOE Contract AC05-84OR21400. (CONF-8810195--: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

The techniques of Rutherford backscattering and channeling spectroscopy have been introduced and shown to be versatile and powerful methods for the study of a variety of ceramic materials. Examples of the applications of these methods to the study of the corrosion of nuclear waste glasses and to the investigation of ion-beam-induced damage and thermal regrowth of complex oxides have been presented along with an additional example of the use of RBS techniques to investigate implantation and annealing effects in the ceramic oxide superconductors of the type $Yba_2Cu_3O_x$.

44716 Analysis of packed-particle rearrangement during colloidal ceramic processing: Gamma-ray densitometry and a review of alternative methods. Schilling, C.H. (Pacific Northwest Lab., Richland, WA (US)); Samuels, W.D.; Aksay, I.A. pp. 181-198 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). DOE Contract AC06-76RL01830. (CONF-8810195--: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

electrostatic and steric repulsion forces that arise during colloidal processing of ceramics affect packed-particle arrangements in the powder consolidation stage and may influence microstructure development during sintering. A gamma-ray attenuation apparatus is used for nondestructive in situ measurement of local porosity and composition during drying, sintering, and a wide range of consolidation processes. A study is presented, which utilizes the apparatus to analyze solution chemistry effects on packed-particle rearrangement during sedimentation of colloidal α-Al_2O_3. Advantages of gamma-ray densitometry for the analysis of ceramic particle rearrangement are compared with those of alternative methods, such as rheology studies, consolidation kinetic modeling, permeability measurements, and various techniques for analyzing porous media.

44717 Morphological evolution of pore channels in alumina. Rodel, J. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.); Glaeser, A.M. pp. 243-257 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract AC03-76SF00098. (CONF-880504--: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

The morphological evolution of pore channels in sapphire bicrystals during annealing at 1800°C has been studied. The effects of boundary crystallography as well as channel orientation within the boundary plane have been examined by using bicrystals with channels etched into either the (0001) or the (1120) planes, and oriented parallel to the [1100] and [1120] directions for the (0001) plane and parallel to the [1100] and [0001] directions in the (1200) plane. The critical aspect ratio for breakup into multiple pores, the kinetics of breakup, and the apparent surface diffusivity are affected by changes in channel crystallography. These behavioral differences are attributed to surface energy anisotropy effects.

44718 Pore drag in alumina. Rodel, J. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.); Glasser, A.M. pp. 280-295 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract AC03-76SF00098. (CONF-880504--: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

This paper introduces a model experiment that allows the study of pore drag and pore-boundary separation under conditions of constant density. Photolithography, ion beam etching, and hot pressing were used to generate microdesigned interfacial pore arrays, consisting of pores of controlled size and spacing, in alumina. Results from an investigation of pore drag suggest that the surface diffusivity in MgO-doped alumina exceeds that in undoped alumina by a factor of 2 to 9 at 1600°C. The condition for pore-boundary separation was found to depend strongly on pore spacing; the influence zone of pores is several microns wide. Concurrent studies of the grain boundary mobility show that the migration rate of basal plane sapphire into undoped alumina is lower than that into MgO-doped alumina.

44719 Structure-property relationships in ferroic nanocomposites. Newnham, R.E. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Trolier-McKinstry, S.E. pp. 235-252 of Ceramic dielectrics: Composition, processing and properties. Volume 8. Ling, H.C.; Yan, M.F. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-890421--: 91. annual meeting of the American Ceramic Society, Indianapolis, IN (USA), 23-27 Apr 1989).

Many of the whisker and precipitate strengthened materials used for structural components can be considered nanocomposites. This paper, however, concentrates on the recent developments in the field of electroceramic nanocomposites, laying particular emphasis on the role of the ferroic materials now utilized as soft ferrite transformers, barium titanate multilayer capacitors, toughened zirconia engine parts, lead zirconate-titanate transducers, and doped barium titanate PTC thermistors. The effect of nano-scale on both the material property coefficients of these systems and on their phase transitions is discussed.

44720 Undoped and low-doped silicon nitride with whisker reinforcement made by glass encapsulated HIP. Larker, H.T.; Adlerborn, J.E. pp. 227-236 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The use of encapsulation in combination with HIP makes it possible to fully densify even high-purity silicon nitride powders. The insufficient volume of liquid phase at consolidation temperature does, however, not allow the desirable formation of elongated beta-silicon nitride grains, common in high-doped or Sialon type silicon nitride alloys. The fracture toughness of undoped silicon nitride will consequently be low, due to the low aspect ratio. Attempts at introducing whiskers of beta-silicon nitride or silicon carbide in undoped or low-doped silicon nitride have been made, and physical properties and microstructure have been studied. 18 refs.

44721 Modification of SIC whisker and SI powder surfaces using organometallic surfactant. Krug, G.; Danforth, S.C. pp. 237-246 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The surfaces of Si powder for reaction bonded silicon nitride (RBSN) and SiC whiskers (SiCw) were modified using selected Si-, Ti-, Zr-, and Al-containing organometallic surfactants. These organometallic surfactants were found to enhance dispersion and reduce the viscosity in a model injection molding formulation (mineral oil, Si powder, SiCw, and dispersant). Increasing the alkyl R group length (CH_3, C8H17, and C18H37) for the Si-based dispersants, was found to enhance dispersion and reduce the viscosity, thereby enabling the use of higher solid loadings. The effect of metal type (Ti, Zr) was investigated, using organometallics with identical alkyl groups (R = OC10H19). It was concluded from results obtained through viscosity and sedimentation experiments that alkyl group chemistry determined the dispersant effectiveness, while the metal type did not. These results suggest that organometallic surfactants can be used to enhance dispersion, reduce viscosity, and potentially tailor the interfacial chemistry in whisker reinforced RBSN composites. 25 refs.

44722 Gas-pressure combustion sintering of TiB2 based composites. Ohmura, Seiji; Miyamoto, Yoshinari; Koizumi, Mitsue. pp. 247-259 of Ceramic materials and components for engines;

Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

A new process of combustion sintering by gas pressure has been developed. By this process, the ceramic composites of titanium borides have been synthesized and simultaneously densified above 97-percent density from the starting compositions of (100-x) (Ti+2B) + x Ti (x = 10-40 wt pct) at 40 to 100 MPa Ar pressures. The product phase included TiB2, Ti3B4 and TiB, depending on the starting compositions, but no Ti metal remained. The grains were below 6 microns. The microhardness and fracture toughness are 20 GPa and 4.1 MPa sq rt m when fabricated from the reactant with x = 10 under 100 MPa, and 19 GPa and 5.6 MPa sq rt m under 40 MPa, respectively. This process is expected to be available for mass production of near-net shape components for a variety of ceramic based composites. 9 refs.

44723 Preliminary study of SiC whisker/Si_3N_4 composite. Gu, Peizhi; Zhang, Weiru; Xiao, Yixian; Fan, Qisheng. pp. 260-272 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Homogeneuous dispersion of SiC whiskers in silicon and silicon nitride matrixes has been achieved by using wet process, ultrasonic, and high-speed homogenizing techniques. Compared with the hot-pressed reaction bonded silicon nitride (HPRBSN) matrix, approximately 50 percent increase in fracture toughness and similar flexural strength for 10 vol pct SiC-whisker containing HPRBSN (SiC W/HPRBSN) composite have been obtained. Effects of additives on nitrided materials are discussed, and the mechanical properties and microstructure of SiC W/HPRBSN composites are evaluated. 10 refs.

44724 Atomic imaging and microanalysis of ceramics at the National Center for Electron Microscopy, Berkeley, California. Thomas, G. (National Center for Electron Microscopy, Materials and Chemical Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Ramesh, R. pp. 287-314 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). DOE Contract AC03-76SF00098. Grant DMR83-1317239. (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

A summary is presented of recent research using atomic resolution imaging and microanalytical procedures that are being applied to a number of ceramic systems at the National Center for Electron Microscopy. This paper illustrates representative problems for which these techniques can provide information toward understanding often complex materials.

44725 Microstructure evolution in microwave sintered alumina. Janney, M.A. (Oak Ridge National Lab., TN (USA)); Kimrey, H.D. pp. 382-390 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract AC05-84OR21400. (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

This paper reports that comparisons have been made of sintering rate, apparent activation energy, surface area, and pore size distribution for alumina sintered in a quasi-optical microwave furnace at 28 GHz and alumina sintered in a conventional tungsten element furnace. The sintering rates for microwave firing were much higher. The apparent activation energy for microwave sintering was about one-third that of conventional sintering. Pore size at a given density was larger for the microwave sintered samples. It is suggested that microwave firing may enhance densification relative to coarsening in sintering.

44726 Effects of the lapped surface layer and surface stress on the dielectric properties on PLZT ceramics. Jiang, Q.Y. (Materials Research Lab., Pennsylvania State Univ., University Park, PA (US)); Krupanidhi, S.B.; Cross, L.E. pp. 375-383 of Ceramic dielectrics: Composition, processing and properties. Volume 8. Ling, H.C.; Yan, M.F. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-890421–: 91. annual meeting of the American Ceramic Society, Indianapolis, IN (USA), 23-27 Apr 1989).

This paper reports the effects of surface layer and surface stress on the dielectric properties of PLZT ferroelectric ceramics studied. The specimens with surfaces prepared by grinding and polishing showed anomalous dielectric properties, i.e. smaller dielectric constant, lower dielectric loss below Curie temperature and smaller polarization than those of the specimens whose lapped surface layers were removed by chemical etching. After annealing at 650°C for 1 hr, the dielectric properties showed improved values; the behavior may be attributed to the existence of surface layers produced during grinding and polishing which seem to be nonferroelectric in nature while under 2-D tensile stress, and having large capacitance of the order of 0.1 - 1.0 $\mu F/cm^2$.

44727 Normal and superconducting properties of the new high T_c oxides and the phonon-plasmon mechanism of superconductivity. Kresin, V.Z. (Lawrence Berkeley Lab., CA (USA). Materials and Chemical Sciences Div.); Morawitz, H. pp. 305-314 of Studies of high temperature superconductors: Volume 2. Narlikar, A. Nova Science Publishers, Inc., Commack, NY (USA) (1989).

This paper describes the phonon-plasmon mechanism of high T_c. How it differs from other layered systems is explored. The authors discuss the temperature dependent electron-loss spectroscopy of layered materials.

44728 Applications of the potential microprobe to electronic ceramic materials. Schubert, W.K. (Sandia National Lab., Albuquerque, NM (US)). pp. 327-339 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

The potential microprobe consists of a fine tipped tungsten needle mounted on a computer controlled, three axion mechanical/piezo positioner. The probe is mounted to the stage of a standard scanning electron microscope, and allows one to make electrical potential measurements on a very fine spatial scal ($\geq$ 10 nm). The potential microprobe and its operation are discussed. Applications of the technique to polycrystalline silicon, ceramic superconductors, and AnO varistor materials are presented.

44729 Photodeflection and photoconductivity studies in ceramics. Seager, C.H. (Sandia National Lab., Albuquerque, NM (US)). pp. 371-382 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

Sensitive calorimetric techniques such as photothermal deflection spectroscopy (PDS) offer many advantages over conventional transmission spectroscopy for measuring the optical properties of ceramics. Insensitivity to light scattering is of particular importance for optical studies of these materials. The physics of the PDS method is reviewed as well as the experimental arrangement necessary to carry out sensitive (3 - 5 ppm) determinations of absorbtance on ceramic specimens over a wide range of photon energies. Examples are given of PDS studies on PLZT and doped ZnO ceramics.

44730 Raman studies of chemical bonding and localized interactions. Exarhos, G.J. (Pacific Northwest Lab., Richland, WA (US)). pp. 383-398 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). DOE Contract AC06-76RL01830. (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

The availability of high intensity laser systems, intensified gated array detectors, and micro-optical imaging devices has led to a resurgence of laser-based molecular spectroscopic techniques for rapid non-destructive analysis of materials. The utility of Raman

spectroscopy as an in situ probe of chemical bonding in bulk materials, dielectric films, and at interfaces will be emphasized in this review. Recent work concerning the response of materials to extreme conditions of pressure and temperature based upon changes in the vibrational Raman spectrum is discussed.

44731 Creep of two ceramics. Wiederhorn, S.M. (National Inst. of Standards and Technology, Gaithersburg, MD (USA)); Hockey, B.J.; Carroll, D.F. pp. 492-505 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

The creep of two phase ceramics is discussed with reference to experimental evidence that suggests that creep of these materials depends on the sign of the applied stress, creep occurring more easily in tension than in compression. To account for such creep asymmetry, one must either assume the existence of alternate pathways for creep deformation, or a creep mechanism that depends on the sign of the applied stress. From experimental data on a fine grain grade of siliconized silicon carbide, alternate pathways (silicon deformation in tension, silicon carbide deformation in compression) are suggested as the main cause of creep asymmetry. Other possible creep mechanisms that lead to creep asymmetry are also discussed. Mechanisms that depend on the sign of the applied stress (cavitation, dilation, sliding friction) are believed to play a secondary role for the siliconized silicon carbide at low stresses, but may be of prime importance for other composites.

44732 Mechanisms of grain growth enhancement and inhibition in donor doped barium titanate. Dynna, G.M. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Materials Science and Engineering); Chiang, Y.M. pp. 547-561 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

This paper reports that the mechanism of grain growth enhancement in donor-doped $BaTiO_3$ has been investigated through grain growth studies, high temperature creep rate measurements, and STEM analyses of grain boundary segregation. It is found that a low donor concentration and a cation stoichiometry of $A/B<1$ are necessary for enhanced grain growth. Creep rates at constant grain size are found to change discontinuously near the eutectic temperature in samples that exhibit rapid growth, but not in fine-grained samples. These results along with STEM measurements showing that grain boundaries in cooled samples are Ti-rich, suggest that the grain growth enhancement at low donor concentrations in $BaTiO_3$ results from changes in the grain boundary transport properties, perhaps due to the formation of a titania-rich grain boundary film at high temperatures. It thus appears that different grain boundary migration mechanisms are operative in the regimes of slow and fast growth in $BaTiO_3$.

44733 Diffusion bonding reactions between silicon nitride, silicon oxynitride and incoloy 909 by hot isostatic pressing. Larker, R.; Loberg, B.; Johansson, T. pp. 503-512 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Solid state bonding diffusion reaction is an attractive route to achieve joints that retain strength at high temperature. Hot isostatic pressing (HIP) can enhance the interfacial area and thereby produce a stronger joint at a lower bonding temperature than other methods. Silicon oxynitride, Si_2N_2O, is often formed on the surface of silicon nitride components during sintering and has several properties that might be beneficial as an interfacial layer against metals. This work concerns the development of solid state bonding methods for the joining of silicon nitride to superalloys by HIP. It presents the first two steps in the development: the synthesis of pure dense Si_2N_2O for joining purposes and the first comparative study of the joining reactions Si_3N_4/superalloy vs Si_2N_2O/superalloy. 6 refs.

44734 Oxidation of sintered silicon nitride materials. Wang, L.; He, C.; Wu, J.G. pp. 604-611 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The oxidation and its effect on mechanical properties of sintered Y_2O_3-Al_2O_3 doped Si_3N_4 were investigated. The weight gain of the material oxidized at 1200 C for 1000 h is 0.4 mg/sq cm which showed the material had excellent oxidation resistance. Oxidation at 1200 C in air greatly improved the high temperature strength of the material. The strength at 1300 C after oxidation at 1200 C for 1000 h is 570 MPa, which is 87 percent higher than that before oxidation. The oxidation mechanism and the reasons for the improvement of high temperature strength are discussed. 5 refs.

44735 Microstructures and mechanical properties of CeO_2-Y_2O_3/ZrO_2 ceramics. Tian, Jiemo; Zhan, Baoqing; Wang, Jialong; Wang, Lingling; Tong, Xiaohua. pp. 612-621 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Microstructures and mechanical properties of CeO_2-Y_2O_3/ZrO_2 ceramics were investigated using ultrafine CeO_2-Y_2O_3/ZrO_2 powder as the starting material. The structures of CeO_2-Y_2O_3/ZrO_2 containing 8 to 12 mol. pct CeO_2 were composed of tetragonal phases. They exhibited an extremely high bending strength and fracture toughness, about 1000 MPa and 15 MPa sq rt m, respectively. The structural details of CeO_2-Y_2O_3/ZrO_2 were studied using TEM, SEM and X-ray diffraction analyses. The effects of the structure on mechanical properties are discussed. 11 refs.

44736 High temperature bending strength and oxidation resistance of beta-sialon prepared with minimal grain boundary phase. Yabuta, K.; Nishio, H.; Okamoto, H.; Umebayashi, S.; Kishi, K. pp. 622-630 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The inherent inhomogeneity of conventional beta-sialons prepared by powder mixing shows low strengths at high temperatures. To reduce this inhomogeneity, aluminum isopropoxide solution was applied as a sintering additive instead of alumina and yttria powder. Consolidation, gas pressure sintering, and hot isostatic pressing provided a full dense beta-sialon ($z = 0.5$). This material exhibited 800 MPa theee-point bending strength from room temperature to 1300 C, and excellent oxidation resistance up to 1600 C. 8 refs.

44737 Mechanical and thermal properties and thermal stability of reaction-sintered Al_2TiO_5 prepared from hydrothermal powders. Peuckert, D.; Hausselt, J.; Kriechbaum, G. W.; Schubert, H. pp. 631-640 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Consideration is given to the mechanical and thermal properties of samples of Al_2TiO_5 reaction-sintered from a hydrothermally synthesized Al_2O_3/TiO_2 mixture at different temperatures and times. Part of the samples were annealed at 900 to 1100 C up to 500 hrs. The sintered and additionally annealed samples are characterized, focusing on microstructure, phase composition, and thermal properties. The influence of sintering and annealing conditions on the material properties of the powders is examined, including the phase stability of SiO_2-doped Al_2TiO_5. It is concluded that hydrothermal synthesis is a suitable technique for preparing very homogeneous and sinteractive powder mixtures that are not prereacted to Al_2TiO_5 before sintering. 12 refs.

44738 Thermal stability of Si_3N_4/SIC whisker composites in air. Bellosi, A.; Babini, G. N. pp. 651-660 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The oxidation behavior of Si_3N_4/SiC whisker composites and of monolithic Si_3N_4 was investigated at temperature up to 1480 C. On the basis of parabolic kinetics and of the microstructural characteristics of the oxide scale, diffusion of Y through the grain boundary phase can be suggested as the rate governing step. At T of 1100 C or less, where Si_3N_4 is stable, weight gains result from the oxidation of SiC whiskers incorporated in the body, when open porosity is present. The thermal stability of the SiC whiskers was also considered: oxidation starts at about 400 C; diffusion of oxygen through the silica layer has been indicated as the slow step in the process. 12 refs.

44739 High temperature silicon aluminum carbonitrides. Oscroft, R.J.; Korgul, P.; Thompson, D.P. pp. 661-672 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Phase relationships have been determined in the Al4C4-SiC-AlN system to explore the occurrence of new silicon aluminum carbonitrides and assess their suitability as high temperature engineering materials. Series of compounds of the type Al4C3.nAlN (n = 1-4) and Al4C3.mSiC (m = 1,2) have similar structures, and some solid solution occurs between end-members with the same metal:nonmetal ratio. In addition, the delta-phase of aluminum carbide, which is a polymorphic modification of the normal 9R structure, has an analog along the Al5C3N-Al4SiC4 line in the form of a 12R modification. 15 refs.

44740 High-strength silicon carbides by hot isostatic pressing. Dutta, S. (Oak Ridge National Laboratory, TN (USA)). pp. 683-695 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Silicon carbide has strong potential for heat engine hardware and other high-temperature applications because of its low density, good strength, high oxidation resistance, and good high-temperature creep resistance. Hot isostatic pressing (HIP) was used for producing alpha and beta silicon carbide (SiC) bodies with near-theoretical density, ultrafine grain size, and high strength at processing temperatures of 1900 to 2000 C. The HIPed materials exhibited ultrafine grain size. Furthermore, no phase transformation from beta to alpha was observed in HIPed beta-SiC. Both materials exhibited very high average flexural strength. It was also shown that alpha-SiC bodies without any sintering aids, when HIPed to high final density, can exhibit very high strength. Fracture toughness K_C values were determined to be 3.6 to 4.0 MPa $m^{1/2}$ for HIPed alpha-SiC and 3.7 to 4.1 MPa $m^{1/2}$ for HIPed beta-SiC. In the HIPed specimens strength-controlling flaws were typically surface related. In spite of improvements in material properties such as strength and fracture toughness by elimination of the larger strength-limiting flaws and by grain size refinement, HIPing has no effect on the Weibull modulus. 19 refs.

44741 Time-temperature dependence of strength in aluminum nitride. Skeele, F.P. (Oak Ridge National Laboratory, TN (USA)); Slavin, M.J.; Katz, R.N. pp. 710-718 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Because of its unique combination of chemical, mechanical, and thermal properties, aluminum nitride (AlN) was investigated as a structural material for advanced heat engine applications. This paper will examine room temperature mechanical properties including hardness, fracture toughness, flexure strength and elastic constants of a hot pressed AlN. Time-temperature-stress behavior is elucidated by stepped-temperature, stress-rupture and isothermal stress rupture tests will be presented. A thorough fractographic examination of the strength limiting flaws and fracture characteristics of AlN will be discussed. 19 refs.

44742 Static, cyclic and dynamic fatigue behavior of silicon nitride. Tajima, Y.; Urashima, K.; Watanabe, M.; Matsuo, Y. pp. 719-728 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Static, cyclic and dynamic fatigue testing of a gas pressure sintered silicon nitride was carried out at several temperatures to study effects of temperature and loading conditions on the fatigue behavior. All the testing was conducted in 3-point bending for specimens without artificial flaws. The dynamic fatigue test results indicated that the material is highly fatigue resistant up to 900 C but becomes susceptible to slow crack growth (SCG) at 1000 C. At room temperature, it is suggested that all the results can be correlated in terms of a single SCG parameter and that there is no significant enhancement of the SCG due to cycling. 11 refs.

44743 Role of oxidation in creep and high temperature failure of silicon nitride. Van der Biest, O.; Weber, C.; Garguet, L.A. pp. 729-738 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Creep and stress rupture behavior of a HPSN (9 wt pct Y_2O_3) was studied in air and nitrogen at 1400 C. This material has excellent creep and static fatigue resistance in comparison with other silicon nitrides. Steady-state creep rates are only marginally influenced by the testing environment or by preoxidation, whereas lifetime is strongly influenced by these factors. At a stress of about 300 MPa, a static fatigue limit exists under inert conditions. Under oxidizing conditions, lifetime may be curtailed by formation of oxidation pits. After lifetimes longer than 10 to the 6th secs in air, another crack initiation mechanism appears which is related to formation of a porous layer underneath the oxide scale. 11 refs.

44744 Grain boundary tailoring of high performance nitride ceramics and their creep property studies. Xu, Y.R.; Yen, T.S.; Fu, X.R. pp. 739-750 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

This investigation has attempted to design a grain boundary phase with yttria and lanthana additives which are highly refractory in the as-fired state and can be recrystallized to enhance the high temperature mechanical properties up to 1300-1400 C. High temperature fracture toughness and creep properties of these materials were studied, and the effect of alumina additions was evaluated. 19 refs.

44745 High temperature cavitation of HIP silicon nitride. Yeckley, R.L. (Oak Ridge National Laboratory, TN (USA)); Siebein, K.N. pp. 751-758 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125--: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Observations of cavitation in liquid phase sintered ceramics found that cavities nucleate and grow within the amorphous grain boundary. Failure is typically controlled by cavity growth through viscous flow mechanisms. Preliminary characterization of cavitation of hot isostatic pressed (HIP) silicon nitride with 4 percent yttria shows cavitation to occur primarily on two grain boundaries. The silicon nitride has a thin amorphous intergranular phase, and yet analytical electron microscopy indicates that diffusional cavitation mechanisms are operative at 1370 C. 21 refs.

44746 Effects of loading rate and temperature on dynamic fracture of ceramic matrix composites. Yang, K.H. (Oak Ridge National Laboratory, TN (USA)); Kobayashi, A.S.; Emery, A.F. pp. 766-775 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

A hybrid experimental-numerical procedure was used to determine the dynamic fracture initiation toughnesses and the dynamic stress intensity factors of alumina, TiB2-particulate/SiC-matrix, and SiC(w)/Al_2O_3-matrix composites at room and elevated temperatures under static and impact loadings. The dynamic fracture initiation toughnesses at room and elevated temperatures were greater than the corresponding static fracture toughness. The crack velocity versus the dynamic stress intensity factor relations showed minor differences due to temperature changes but significant differences due to the change in loading rates. 14 refs.

44747 Investigation of selected Si_3N_4 and SiC ceramics. Hecht, N.L. (Oak Ridge National Laboratory, TN (USA)); McCullum, D.E.; Graves, G.A. pp. 806-816 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

A three-phase project has been carried out to investigate the effects of environment on the mechanical behavior of commercially available ceramics considered for heat engine applications. Phase I, concerned with the evaluation of transformation toughened ceramics, has been completed. Phases II and III are concerned with the evaluation of SiC and Si_3N_4 ceramics. Microstructure, chemistry, physical properties, and mechanical behavior at 25-1450 C are investigated. A major focus of these evaluations is the flexural strength and dynamic fatigue of these materials from 1000-1450 C. 29 refs.

44748 Correlation of subcritical crack growth and microstructure in HIP-SiC. Braue, W.; Goering, J.; Ziegler, G. pp. 817-830 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Two grades of hot isostatic pressed (HIP-)SiC - undoped and with 0.2 wt pct Al added as sintering aid - were tested with respect to subcritical crack growth. Mechanical testing established a distinct crack extension above 900 C, which was identified as intergranular fracture area at the fracture surface. Subcritical crack extension was found to be more pronounced in the Al-doped material. In both HIP-SiC materials, nm-sized noncrystalline secondary phases were identified via convergent beam electron diffraction at triple grain junctions which are regarded to promote subcritical crack growth. Small probe microanalysis of these amorphous phases revealed an aluminum silicate composition. 12 refs.

44749 Strength degradation of silicon nitride based ceramics by hot corrosion in alkali sulfate and carbonate melts. Shimada, M.; Sato, T.; Koike, Y.; Endo, T. pp. 831-840 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The effect of additives on the corrosion rate and strength degradation of Si_3N_4-based ceramics in K_2SO_4 and K_2CO_3 melts was experimentally studied, along with the time to rupture for the corroded Si_3N_4 ceramics. It was found that the surface chemical reaction-controlled shrinking core model can be applied to describe the relationship between the degree of the corrosion and the reaction time for the corrosion of Si_3N_4-based ceramics in K_2SO_4 and K_2CO_3 melts. The corrosion rate in K_2CO_3 melts decreased with increasing content of aluminum and yttrium ions in the specimen. Corrosion resulted in roughness of specimen surfaces and degraded fracture strengths to 2/3-2/5 of their original values up to 2 percent of weight loss. Fracture strength was almost constant up to 30 percent of weight loss. 11 refs.

44750 Biaxial static fatigue of silicon nitride. Quinn, G.; Wirth, G. pp. 871-882 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The equibiaxial static fatigue resistance of hot-pressed silicon nitride was evaluated at high temperature. A ring-on-ring apparatus was used for stress rupture testing of disk specimens up to 1300 A in air. Equibiaxial lifetimes were substantially shorter than uniaxial lifetimes at similar stress levels. The strength degradation trends were identical, however. 11 refs.

44751 Preparation of Ce-TZP and its mechanical behavior. Yang, S.G.; Chen, K. pp. 904-906 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Transformation toughened ZrO_2 with 12 mol pct CeO_2 (Ce-TZP) was investigated. The addition of Al_2O_3 and TiO_2 was found to be very effective in lowering the sintering temperature and raising the mechanical properties at room temperature. The additions of 11-18 wt pct Al_2O_3 and 0.5-2 wt pct TiO_2 to 12 mol pct CeO_2-ZrO_2 gave rise to a remarkable increase in the fracture toughness, flexural strength, and microhardness. The effects of the additives are discussed. 13 refs.

44752 Strengthening of oxide ceramics by SiC and Si_3N_4 dispersions. Niihara, K.; Nakahira, A. pp. 919-926 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The Al_2O_3-SiC, Al_2O_3-Si_3N_4 and MgO-SiC composites series have been investigated to improve mechanical and thermomechanical properties of Al_2O_3 and MgO ceramics. These composites were prepared by hot-pressing mixtures of fine powders at 1500 to 1900 C with 28 MPa applied pressure. The striking finding in these composites is that the fracture strength of Al_2O_3 and MgO ceramics was increased approximately 1.5 to 3 times by incorporating very fine SiC and Si_3N_4 particles, and this strength improvement was also observed even in the temperature range from 1200 to 1400 C. 19 refs.

44753 Microstructure and mechanical properties of SiC whiskers/CeO_2-Y_2O_3 doped ZrO_2 composites. Tian, Jiemo; Zhan, Baoqing; Tong, Xiaohua; Wang, Lingling; Wang, Jialong. pp. 950-957 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Beta-SiC whiskers/CeO_2-Y_2O_3 doped ZrO_2 composites with whisker contents of approximately 15 vol pct were hot-pressed at 1500 C to high densities. The addition of SiC whiskers was observed to increase fracture toughness of CeO_2-Y_2O_3-ZrO_2 ceramics. The ceramic micromorphologies are given by SEM photographs and EDAX analysis. They show beta-SiC whiskers inserted into CeO_2-Y_2O_3-ZrO_2 matrix very strongly. The toughening mechanism of SiC whiskers in Y-Ce-TZP ceramics is discussed. 15 refs.

44754 Creep behavior of SIC(w)/Al_2O_3 composites. Liu, D.S. (Oak Ridge National Laboratory, TN (USA)); Majidi, A.P. pp. 958-967 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Creep experiments were performed on a SiC-whisker reinforced alumina composite at temperatures of 1150 and 1250 C in an air environment and at initial elastic stresses ranging from 130 to 320 MPa. Reaction phases were found on the surfaces of all specimens after testing. Removal of the reaction layer revealed the presence of creep cracking on the tensile faces of several specimens. Whisker bridging and evidence of whisker pullout were found and are suggested to be factors responsible for the enhanced creep resistance of this material. 11 refs.

44755 Mechanical properties and microstructures of Si_3N_4-BN composite ceramics. Funahashi, Toshihiko; Isomura, Keiichiro; Harita, Akira; Uchimura, Ryoji. pp. 968-976 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

A new type of composite ceramic of the Si_3N_4-BN system has been developed using a method which utilizes homogeneous mixing of ultra-fine constituent ceramic powders and gas pressure sintering. An essential feature of Si_3N_4-BN composite ceramics is that their mechanical properties can be tailored over a wide range by changing the BN contents. Another remarkable feature is that the composite ceramics are machinable while retaining relatively high strength, i.e., the bending strength of machinable composite ceramics with 10 and 20 wt pct BN is 350 and 200 MPa, respectively. These values are more than two times higher than those of conventional machinable ceramics, such as Si_3N_4-BN composite ceramics made by a reaction sintering method of machinable mica ceramics. In addition, the thermal shock resistance is improved remarkably by increasing the BN content compared with Si_3N_4 ceramics. 7 refs.

44756 Reversible transformation mechanism in Ce-TZP. Huang, Y.; Zeng, Z.Q.; Zheng, L.L.; Jiang, Z.Z. pp. 1006-1019 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

The phase transformation behavior of t-ZrO_2 to m-ZrO_2 for Ce-TZP under stressing or a high radiation intensity electron beam is investigated in detail. XRD measurements show that the transformation from t-ZrO_2 to m-ZrO_2 occurs when tensile stress is applied to Ce-TZP containing 10 mol pct CeO_2 samples and m-ZrO_2 is partially transformed back to t-ZrO_2 when the stress is removed. Reversible transformation between t-ZrO_2 and m-ZrO_2 is also demonstrated by in situ TEM observations. The results suggest the ZrO_2 martensitic transformation mechanism in Ce-TZP is stress-assisted and deformation-induced. Laser Raman microprobe measurements show that the transformation zone size of Ce-TZP is much larger than that of other ZrO_2 transformation-toughened ceramics and that the distribution of m-ZeO_2 is not uniform in the transformation zone. The results suggest that the toughening mechanism of stress-induced transformation does not apply to Ce-TZP. 5 refs.

44757 Toughening of oxide ceramics by residual stress domains. Lutz, E.; Claussen, N. pp. 1020-1030 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

A microstructure design concept is applied which enables high-strength ceramics to exhibit a pronounced R-curve behavior. This yields large work-of-fracture values and low strength degradation after thermal shock. The concept is based on relatively large (10-50 microns) spherical zones dispersed in a strong matrix. The spherical zones expand relative to the matrix, which introduces long-range tensile hoop stresses around the zones. Flaws propagating due to excessive stresses are deflected by branching toward the compressive zones and are arrested at or near the interface (stress boundary). R-curve mechanisms, similar to those operating in low-strength refractories, are acting (crack bridging, crack branching). The concept has previously been tested by Claussen and Petzow (1983) with Al_2O_3 and ZrO_2-toughened Al_2O_3 and is here being tested with 2Y-PSZ, 3Y-TZP, and Al_2O_3-alloyed TZP as matrix. 28 refs.

44758 Dislocation structures within spinel crystal fracture surfaces. Richardson, G.Y. (Oak Ridge National Laboratory, TN (USA)); Wu, C.CM.; Armstrong, R.W. pp. 1039-1050 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Nondestructive characterization of dislocation structures in fracture surfaces produced by three-point bend testing of spinel ($MgAl_2O_4$) single crystals has been accomplished by surface reflection X-ray diffraction topography (XRDT). Different dislocation structures were observed within the surface layers for 100-plane, 110-plane, and 111-plane fracture surfaces. Scanning electron microscopy was employed to characterize the external fracture surface features and for direct comparison with XRDT images of the fracture surface layer. A stereographic projection method illustrates the geometry of the fracture experiment as well as the X-ray diffraction geometry. The method appears to be useful for determining a priori the dislocation structures induced by the fracture process. 26 refs.

44759 Impact damage of silicon carbide and silicon nitride. Hara, Y.; Hamada, S.; Minematsu, T.; Takahashi, H.; Abe, H. pp. 1179-1188 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Ball contact damage was investigated for the case of static and impact loading for SiC and Si_3N_4. Impact tests using an air-gun system were carried out in the range of 40-160 m/s impact speed. In the case of SiC specimens, main failures due to ball contact were Hertzian cracks or cone-shape cracks. There are slight differences between the static and impact tests, and the residual strength decreased gradually with increase in contact load. In the case of Si_3N_4 specimens with steel ball indent, there was no degradation of strength in either static or impact tests. On the other hand, radical degradation of strength occurred by the impact with SiC and Si_3N_4 balls. Some deep median cracks were the cause of higher degradation of strength in contrast to SiC specimens.

44760 Smedskjaer, Bansil, and Mijnarends reply. Smedskjaer, L.C. (Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Bansil, A.; Mijnarends, P.E. *Physical Review Letters (USA)*, 65(1): 136-136 (2 Jul 1990). DOE Contract FG02-85ER45223 ;W-31109-ENG-38.

A reply to the comment is given on Fermi surface, ground-state electronic structure, and positron experiments in YBaCu. It is believed that the wider implication of the comment is not correct and since these authors have chosen to limit themselves to a discussion of the derivatives is based on an incomplete analysis of the data. (AIP)

44761 Antiferromagnetic spin correlations in $(Nd,Pr)_{2-x}Ce_xCuO_4$. Thurston, T.R. (Department of Physics, Tohoku University, Sendai 980 (Japan)); Matsuda, M.; Kakurai, K.; Yamada, K.; Endoh, Y.; Birgeneau, R.J.; Gehring, P.M.; Hidaka, Y.; Kastner, M.A.; Murakami, T.; Shirane, G. *Physical Review Letters (USA)*, 65(2): 263-266 (9 Jul 1990). DOE Contract AC02-76CH00016.

Neutron-scattering measurements have been performed on $(Nd,Pr)_{2-x}Ce_xCuO_4$ ($0.0<x<0.125$) single crystals. All samples exhibit three-dimensional (3D) long-range magnetic order; the temperature dependence of the 2D magnetic correlation lengths in all is similar in character to that observed in pure and lightly doped La_2CuO_4 albeit with renormalized spin stiffness constants ρ_s. Thus, in the nonsuperconducting doping regime the hole- and electron-doped systems exhibit analogous magnetic behavior except for the drastically different dopant-concentration scales for the destruction of magnetic order.

44762 Study of protons in acceptor-doped $KTaO_3$ crystals by IR and EPR techniques. Fu, S.Q. (Columbia Univ., New York, NY (USA)); Lee, W.K.; Nowick, A.S.; Boatner, L.A.; Abraham, M.M. *Journal of Solid State Chemistry (USA)*, 83(2): 221-229 (Dec 1989). DOE Contract FG02-88ER45341 ;AC05-84OR21400.

In order to understand the manner of incorporation of protons into perovskite structure oxides, $KTaO_3$ crystals containing acceptor dopants Co^{2+}, Mn^{2+}, Cu^{2+}, and Fe^{3+} were investigated following thermal treatments in various partial pressures of O_2 and H_2O. IR measurements were used to monitor the proton content through the OH^- absorption bands, while quantitative EPR measurements wee used to determine the changes in the local environment of the dopant ion. It is shown that the introduction of protons during high-temperature treatments in H_2O is accompanied by the replacement of the oxygen-ion vacancies (V_o) that initially compensated the acceptor dopants by O^{2-} ions. In the case of the M^{2+} dopants, the dopant-vacancy association free energy is sufficiently strong to retain the M-V_o pairs even during high-temperature (900°C) treatments; thus, only <100> axial EPR spectra due to such pairs are observed. For Fe^{3+} dopants, however, virtually all of the V_o can be replaced by O^{2-}, leaving the Fe^{3+} ion in a cubic environment. The results also show evidence for valence changes of the Co, Mn, and Cu dopants when treatments change from oxidizing to reducing atmospheres.

44763 Electronic structure of the gold/$Bi_2Sr_2CaCu_2O_8$ and gold/$EuBa_2Cu_3O_{7-\delta}$ interfaces as studied by photoemission spectroscopy. Dessau, D.S. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (USA)); Shen, Z.; Wells, B.O.; Spicer, W.E.; List, R.S.; Arko, A.J.; Bartlett, R.J.; Fisk, Z.; Cheong, S.; Mitzi, D.B.; Kapitulnik, A.; Schirber, J.E. *Applied Physics Letters (USA)*, 57(3): 307-309 (16 Jul 1990).

High-resolution photoemission has been used to probe the electronic structure of the gold/$Bi_2Sr_2CaCu_2O_8$ and gold/$EuBa_2Cu_3O_{7-\delta}$ interface formed by a low-temperature (20 K) gold evaporation on cleaved high quality single crystals. We find that the metallicity of the $EuBa_2Cu_3O_{7-\delta}$ substrate in the near surface region (~5 A) is essentially destroyed by the gold deposition, while the near surface region of $Bi_2Sr_2CaCu_2O_8$ remains metallic. This has potentially wide ranging consequences for the applicability of the different types of superconductors in real devices.

44764 Specific heat of $YBa_2Cu_3O_7$: Origin of the "linear" term and volume fraction of superconductivity. Phillips, N.E. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, CA (USA)); Fisher, R.A.; Gordon, J.E.; Kim, S.; Stacy, A.M.; Crawford, M.K.; McCarron, E.M. III. *Physical Review Letters (USA)*, 65(3): 357-360 (16 Jul 1990). DOE Contract AC03-76SF00098.

Correlations of the coefficient of the "linear" term in the specific heat, $\gamma(0)$, and the discontinuity at T_c, $\Delta C(T_c)$, with a measured concentration of Cu^{2+} magnetic moments suggest the operation of a pair-breaking mechanism that limits the transition to the superconducting state and produces a contribution to $\gamma(0)$. There is no evidence for the existence of an intrinsic contribution to $\gamma(0)$. The value of $\Delta C(T_c)$ for a sample provides a measure of the volume fraction of superconductivity and a basis for correcting measured values of parameters to those characteristic of the fully superconducting state. Estimates of several quantities relevant to the strength of coupling are given.

44765 Incommensurate modulations in the Pb-doped BiSr-CaCuO 221 superconducting phase: A five-dimensional superspace description. Gao, Yan (State Univ. of New York, Buffalo (USA)); Lee, P.; Graafsma, H.; Yeh, J.; Bush, P.; Petricek, V.; Coppens, P. *Chemistry of Materials (USA)*, 2(3): 323-328 (May-Jun 1990).

The new modulation introduced by Pb doping of the 221 BiSr-CaCuO superconducting phase has been analyzed by using five-dimensional superspace group theory. The complete X-ray diffraction pattern has monoclinic rather than orthorhombic symmetry and is in agreement with the superspace group P:Aa:1. In addition to the original modulation with q_1 = 0.234 (1)a, an extra set of satellites with q_2 = 0.144 (3)a, and combination satellites with $q_1 - q_2$ = 0.090 (1) occur. The two modulations differ in the internal translational symmetry. Anomalous dispersion experiments show the both Bi and Pb atoms are affected by each of the modulations, a conclusion confirmed by the diffraction analysis.

44766 Growth twins in $Bi_2Ca_1Sr_2Cu_2O_8$ superconductor single crystals. Han, P.D. (Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering); Asthana, A.; Xu, Z.; Payne, D.A. *Journal of Materials Research (USA)*, 5(5): 909-912 (May 1990). DOE Contract AC02-76ER01198.

Large-scale twin structures in single crystal $Bi_2Ca_1Sr_2Cu_2O_8$(2122) are reported for the first time. Symmetrical 90° (i.e., *a-b*) twins with a [110] type twin boundary were observed. A characteristic layer-growth morphology and jagged twin walls suggests that twin formation occurred layer by layer during crystal growth, i.e., the twins were growth twins. Hot-stage optical microscopy, x-ray diffraction, and electron microscopy results are discussed with reference to twin morphology.

44767 Observations and implications of grain boundary dislocation networks in high-angle $YBa_2Cu_3O_{7-\delta}$ grain boundaries. Babcock, S.E. (University of Wisconsin, Madison, Wisonsin 53706 (USA). Applied Superconductivity Center); Larbalestier, D.C. *Journal of Materials Research (USA)*, 5(5): 919-928 (May 1990).

Regular networks of localized grain boundary dislocations (GBDs) have been imaged by means of transmission electron microscopy in three different types of high-angle grain boundaries in $YBa_2Cu_3O_{7-\delta}$, implying that these boundaries possess ordered structures upon which a significant periodic strain field is superimposed. The occurrence of these GBD networks is shown to be consistent with the GBD/Structural Unit and Coincidence Site Lattice (CSL)/Near CSL descriptions for grain boundary structure. Thus, these dislocations appear to be intrinsic features of the boundary structure. The spacing of the observed GBDs ranged from ~10 nm to ~100 nm. These GBDs make the grain boundaries heterogeneous on a scale that approaches the coherence length and may contribute to their weak-link character by producing the "superconducting micro-bridge" microstructure which has been suggested on the basis of detailed electromagnetic measurements on similar samples.

44768 Mechanical properties of nanophase TiO_2 as determined by nanoindentation. Mayo, M.J. (Ceramics Development Division, Sandia National Laboratories, P. O. Box 5800, Albuquerque, New Mexico 87185 (USA)); Siegel, R.W.; Narayanasamy, A.; Nix, W.D. *Journal of Materials Research (USA)*, 5(5): 1073-1082 (May 1990). DOE Contract AC04-76DP00789 ;W-31109-ENG-38 ;FG03-89ER45387.

Nanoindenter techniques have been used to determine the hardness, Young's modulus, and strain rate sensitivity of nanophase TiO_2, which is currently available only in very small quantities and which cannot be tested by most conventional techniques. Hardness

and Young's modulus both increase linearly with sintering temperature over the range 25–900 °C but come to within only 50–70% of the single crystal values. Strain rate sensitivity, on the other hand, is measurably greater for this material than for single crystal rutile, and the value of strain rate sensitivity increases as the grain size and the sintering temperature are decreased. In its as-compacted form, the strain rate sensitivity of nanophase TiO_2 is approximately a quarter that of lead at room temperature, indicating a potential for significant ductility in these ceramic materials. Finally, a significant scatter in hardness values has been detected within individual nanophase samples. This is interpreted as arising from microstructural inhomogeneity in these materials.

44769 Oxide thin films for nanometer scale electron beam lithography. Hollenbeck, J.L. (Ceramics Division, Department of Materials Science and Engineering, University of Illinois, Urbana, Illinois 61801 (USA)); Buchanan, R.C. *Journal of Materials Research (USA),* 5(5): 1058-1072 (May 1990). DOE Contract AC02-76ER01198.

The exposure response of high resolution oxide resist materials has been examined under high intensity irradiation conditions ($\sim 1\times10^5$ A/cm^2) to determine the relationships among film characteristics, exposure requirements, and ultimate resolution, and to explore further the processes responsible for ablative exposure. Amorphous films of Al_2O_3, Y_2O_3, Sc_2O_3, $3Al_2O_3{\cdot}2SiO_2$, and $MgO{\cdot}Al_2O_3$ were deposited by rf sputtering onto substrates cooled to −196 °C and found to require an exposure dose of approximately 5×10^3 C/cm^2 to complete exposure. Amorphous film structure was found to be necessary to achieve rapid removal of material during exposure. Material properties also found to influence irradiation response and help guide the selection of new materials included ionic character, heat of formation, and melting point. Film thickness was found to strongly influence both exposure requirements and resolution, an optimum thickness occurring at approximately 90 nm in amorphous Al_2O_3. The dose requirement in 90 nm thick amorphous Al_2O_3 was determined to be 2.5×10^3 C/cm^2, which is two to three orders of magnitude lower than that of oxide films produced by other techniques, and the resolution of the rf sputtered oxide films allowed the production of 5.0 nm holes on 8.1 nm centers. A dedicated STEM was used for exposure studies as well as imaging, microdiffraction analysis, and monitoring of the transmitted beam current, and allowed a qualitative model of the exposure process in rf sputtered oxide resists to be developed.

44770 Charge-state stability of Ni and Cu impurities in MgO. Meng, J. (Department of Physics, Virginia Commonwealth University, 1020 West Main Street, P.O. Box 2000, Richmond, Virginia 23284-2000 (USA)); Jena, P.; Vail, J.M.; Stoneham, A.M. *Physical Review, B: Condensed Matter (USA),* 42(2): 1156-1162 (15 Jul 1990). DOE Contract FG05-87ER45316.

Total energies for substitutional Ni and Cu ions in MgO are studied for their 1+, 2+, and 3+ charge states. These are used to assess charge-state stability. Specifically, electron loss to the conduction band for Ni^+ and electron capture from the valence band for Ni^{3+} and Cu^{3+} are considered. The impurity and its near-neighboring ions are analyzed in the unrestricted Hartree-Fock self-consistent-field approximation, as a molecular cluster embedded in a consistently relaxed shell-model lattice. The results indicate that both electron loss for n=1 and electron capture for n=3 should occur, so that disproportionation of the various charge states is intrinsically unstable.

44771 Metal buffer layers and Y-Ba-Cu-O thin films on Pt and stainless steel using pulsed laser deposition. Russo, R.E. (Lawrence Berkeley Laboratory, Applied Science Division, Berkeley, California 94720 (USA)); Reade, R.P.; McMillan, J.M.; Olsen, B.L. *Journal of Applied Physics (USA),* 68(3): 1354-1356 (1 Aug 1990). DOE Contract AC03-76SF00098.

A versatile pulsed laser deposition chamber was employed for fabricating metal buffer layers and superconducting YBaCuO thin films on metallic substrates. Ag buffer layers were found to improve the resistive transition behavior for superconducting films on Pt and stainless steel. As-deposited YBaCuO films with T_c (R=0) at 84 K were produced on stainless steel using *in situ* laser-deposited Ag buffer layers. The critical current density was measured to be approximately 10^3 A/cm^2 at 67 K.

44772 Distribution of molybdenum oxidation states in reduced Mo/TiO_2 catalysts: Correlation with benzene hydrogenation activity. Quincy, R.B. (Univ. of Pittsburgh, PA (USA)); Houalla, M.; Proctor, A.; Hercules, D.M. *Journal of Physical Chemistry (USA),* 94(4): 1520-1526 (22 Feb 1990).

A 5 wt % MoO_3/TiO_2 catalyst was reduced in hydrogen at various temperatures to produce a surface with average Mo oxidation states between +6 and 0. The changes in molybdenum oxidation states as a function of the extent of reduction were monitored by gravimetric analyses and x-ray photoelectron spectroscopy (XPS, ESCA), and the results were correlated with benzene hydrogenation activity. ESCA Mo $3d_{5/2}$ binding energy values for the various Mo oxidation states on a 5 wt % MoO_3/TiO_2 catalyst show a shift of 5.1 eV between Mo^{+6} (232.7 eV) and Mo^0 (227.6 eV). The benzene hydrogenation activity was found to depend strongly on the extent of reduction of the Mo phase. Comparison of benzene hydrogenation activity with the distribution of Mo oxidation states determined by ESCA suggests that molybdenum ions with an oxidation state of +2 are the most active species.

44773 Beryllium-hydrogen ultrathin films. II. Ground-state properties of the dilayer. Wu, J.Z. (Quantum Theory Project, Department of Physics—Department of Chemistry, University of Florida, Gainesville, Florida 32611 (USA)); Trickey, S.B.; Boettger, J.C. *Physical Review, B: Condensed Matter (USA),* 42(3): 1668-1673 (15 Jul 1990).

The thinnest possible realization of H over Be, the heterogeneous dilayer (Be 1-layer and H 1-layer) has three possible H positions of high symmetry relative to the Be 1-layer (1L). With Be(0001) symmetry: open, overhead, and bridge. Of these, we predict the open site to be energetically favored, with an equilibrium interplanar distance c=2.02±0.02 a.u., and intraplanar distance a_h=4.01±0.02 a.u. All three conformations are predicted to be metallic. The total energies, uniaxial energy second derivatives, and Kohn-Sham energy bands, as determined by all-electron, full-potential, local-density-functional calculations are also reported. Comparison with previous extended and cluster-model calculations on H over Be shows that Be-H 2L has the same site ordering (open preferred over bridge over overhead) as the $Be_{36}H$ cluster but not the same as the 1L-4L-1L supercell (bridge preferred over open over overhead). Extended-system and large-cluster models give calculated values of a_{BeH} that are grouped closely. The work function of the 2L is a strong function (a volt or more) of site configuration. For the preferred open site, it is 0.9 eV below the value for the bare Be 1L and 0.6 eV below the bulk Be experimental value.

44774 Beryllium-hydrogen ultrathin films. I. Metallic behavior of the BeH_2 monolayer. Wu, J.Z. (Florida Univ., Gainesville, FL (USA). Quantum Theory Project); Trickey, S.B.; Boettger, J.C. *Physical Review, B: Condensed Matter (USA),* 42(3): 1663-1667 (15 Jul 1990).

Equilibrium lattice parameters, total energies, the in-plane energy second derivative, and Kohn-Sham energy bands for the BeH_2 1-layer are determined by all-electron, full-potential, local-density-functional calculations. The BeH_2 1-layer is predicted to be metallic, in contrast with a previous Hartree-Fock calculation which predicted large-gap insulating behavior. By direct calculation, this disparity is traced to basis-set restrictions in the Hartree-Fock calculation that drive the highly localized Be surface state into the conduction band. The minimum-energy lattice constant a_s (i.e., the square edge that is twice the Be-H distance) for the BeH_2 1-layer is 5.51 a.u. The calculated H-H distance is 3.90 a.u., lower than Switendick's empirical criterion (3.97 a.u.) for stable metal hydrides but still well above the 3.40 a.u. involved in Overhauser's conjecture about superconductivity in $LiBeH_3$.

44775 Photoemission study of CoO. Shen, Z. (Stanford Electronics Laboratory, Stanford University, Stanford, California 94305 (USA)); Allen, J.W.; Lindberg, P.A.P.; Dessau, D.S.; Wells, B.O.; Borg, A.; Ellis, W.; Kang, J.S. *Physical Review, B: Condensed Matter (USA),* 42(3): 1817-1828 (15 Jul 1990). DOE Contract AC03-82ER13000.

We have performed resonance photoemission, angle-resolved photoemission, and core-level photoemission studies of single-crystalline CoO. On the one hand, strong correlation effects among

the *d* electrons are observed, as signaled by a strong reduction of Co 3*d* bandwidths and satellites in both the valence band and the cation core levels. On the other hand, the oxygen states are found to be very bandlike, as indicated by strong dispersions of oxygen states in the valence band and the lack of oxygen satellites. We give estimations of 30 and 1.5 for *U/W* (Coulomb interaction divided by bandwidth) ratio of Co 3*d* bands and O 2*p* bands, respectively. By comparing the experimental and theoretical *E* versus k relation, we show that the density-functional band calculation works well for the oxygen bands but not for the Co bands. We argue that CoO is not a band insulator, but a charge-transfer insulator. We have also observed the effects of local magnetic order on the electronic structure. Finally, we suggest a guideline on calculating the band structure of CoO: introducing a mechanism that reduces the Co 3*d* bandwidth by 25% while still retaining the other essential features of the band calculation.

44776 Li_2O-Al_2O_3-SiO_2 glass ceramic-aluminum containing austenitic stainless steel composite body and a method of producing the same. Cassidy, R.T. To Dept. of Energy, Washington, DC (USA). USA Patent 4921738/A/. 1 May 1990. Filed date 9 Dec 1988. USA Patent Application 7-281,729. Int. Cl. B32B 15/00. vp. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a hermetically sealed glass ceramic-metal composite body. It comprises: a substantially cylindrical metal member consisting essentially of an austenitic stainless steel containing 4.0–5.5 wt % Al; a glass ceramic member fixed within the metal member, consisting essentially of a crystallized Li_2O-Al_2O_3-SiO_2 glass ceramic substantially free from amorphous material and having a thermal expansion coefficient substantially matching that of the metal member; an interfacial layer consisting essentially of Al_2O_3 between the metal member and the glass ceramic member, wherein the Al_2O_3 region consists of constituents of the metal member and constituents of the glass ceramic member.

3606 Other Materials

Refer also to citation(s) 43895, 43937, 43940, 43942, 43992, 44026, 44039, 44061, 44129, 44130, 44135, 44136, 44137, 44138, 44139, 44195, 44203, 44489, 44503, 44504, 44515, 44568, 44572, 44615, 44621, 44626, 44642, 44660, 44684, 44857, 44867, 44882, 44883, 44884, 44888, 44925, 44931, 44935, 44994, 45041, 45042, 45043, 45046, 45054, 45060, 45071, 45181, 45287, 45298, 45919, 46064, 46070, 46210

44777 (AD-A–221334/6/XAB) **Preparation and characterization of properties of oxynitride glasses and fibers. Final report.** Gleisner, R.P.; DiGuiseppe, T.G. Geo-Centers, Inc., Newton Upper Falls, MA (USA). Jul 1989. 46p. (GC-TR–89-1658). Source: NTIS, PC A03/MF A01.

It has been shown that the substitution of nitrogen for oxygen in oxide glass structures enhances bond strength, which results in glasses having outstanding properties. These oxynitride glasses have higher elastic moduli, tensile strength, hardness, and better corrosion resistance than oxide glasses. Previous work at MTL demonstrated techniques for making significant quantities of these oxynitride glasses. It was also recognized that these glasses had the potential to be formed into glass fibers. Such glass fibers would have potential applications in high-performance composites.

44778 (AD-A–221494/8/XAB) **Composite materials with improved properties in compression. Appendix 1. Cyclopropanation of poly(1-methyl-1-phenyl-1-sila-cis-pent-3-ene). Synthesis and characterization of poly(1-methyl-3,4-methylene-1-phenyl-1-sila-cis-pent-3-ene). Interim report.** Liao, X.; Lee, H.S.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 9 May 1990. 16p. Source: NTIS, PC A03/MF A01.

There is considerable interest in the chemical modification of polymers. While it has been possible to stereo specifically quantitatively add dichlorocarbene to the C-C double bonds of 1,4-polybutadiene as well as to those of poly(1,1-dimethyl-1-sila-cis-pent-3-ene) (II), it has not been possible to achieve complete cyclopropanation of the C-C double bonds of either 1,4-polybutadiene or II by use of the Simmons-Smith reaction. NMR spectra were obtained either on a Brucker AM-360 or an IBM Brucker WP-270-SY spectrometer operating in the Fourier transform mode. Five to ten percent weight/volume solutions of polymers C12C-I and H2C-I in chloroform-d were used to obtain NMR spectra, whereas ten to fifteen percent solutions were utilized for ^{13}C and ^{29}Si NMR spectra. BC NMR spectra were run with broad band proton decoupling. Chloroform was used as an internal standard for 1H and 13C NMR spectra.

44779 (AD-A–221616/6/XAB) **Silver-bearing, high-temperature, superconducting (HTS) paint.** Ferrando, W.A. Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab. 15 Feb 1990. 25p. (NSWC-TR–90-48). Source: NTIS, PC A03/MF A01.

A substantial set of device applications awaits development of a workable, durable, high-temperature superconducting (HTS) paint. Such a paint should be truly superconducting with its critical temperature T sub c>77K. For most of these applications, a high critical current (J sub c) is not required, although probably desirable. A process is described which can be used to produce silver-bearing HTS paint coatings on many engineering materials. Preliminary tests have shown good adherence to several ceramics and the ability to meet the superconducting criteria. Moreover, the coatings withstand multiple thermal cycling and stability under laboratory ambient storage conditions for periods of at least several months.

44780 (AD-A–221645/5/XAB) **Composite materials with improved properties in compression. Appendix 5. Synthesis and anionic ring-opening polymerization of 1-germa-1,1-dimethyl(3,4,c)thienocyclopentane. Interim report.** Zhou, S.Q.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 9 May 1990. 7p. Source: NTIS, PC A02/MF A01.

While there has been extensive work on several types of polymers having silicon in the chain due to their scientific and industrial importance, few studies on polymers containing germanium in the backbone have been reported. Despite this limited research, polygermanes have been observed to have interesting properties. For example, they have been found to be photoactive. They undergo photobleaching as well as to have thermochromic properties. Most recently, germylenes, stable divalent germanium species, have been found to undergo a novel oxidation-reduction copolymerization with benzoquinones. Anionic ring opening polymerization of I yields III, a carbogermanium polymer in which both carbon and germanium atoms make up the polymer backbone.

44781 (AD-A–221647/1/XAB) **Composite materials with improved properties in compression. Appendix 2. Anionic ring opening polymerization of 1-silacyclopent-3-ene. Characterization of poly(1-sila-cis-pent-3-ene) by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy. Interim report.** Zhou, S.Q.; Park, Y.T.; Manuel, G.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 9 May 1990. 8p. Source: NTIS, PC A02/MF A01.

1-Silacyclopent-ene (I) undergoes anionic ring opening polymerization catalyzed by methyllithium/HMPA to yield poly(1-sila-cis-pent-3-ene) (II). II was characterized by ^{1}H, ^{13}C and ^{29}Si NMR, TGA and elemental analysis. The low molecular weight of II permits end group analysis. Pyrolysis of II gives high char yields. These have been characterized by EDS.

44782 (AD-A–221648/9/XAB) **Composite materials with improved properties in compression. Appendix 4. Addition of difluorocarbene to poly(1-methyl-1-phenyl-1-sila-cis-pent-3-ene). Characterization of microstructures by ^{1}H, ^{13}C, and ^{19}F and ^{29}Si NMR. Interim report.** Lee, H.S.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 9 May 1990. 3p. Source: NTIS, PC A01/MF A01.

There is considerable interest in the chemical modification of polymers (1-3). Dichloro (4-7) and difluorocarbene (8) add stereospecifically to the C-C double bonds of cis and trans-1,4-polybutadiene.

44783 (AD-A-221649/7/XAB) **Composite materials with improved properties in compression. Anionic ring opening polymerization of 2-methyl-2-silaindan. Characterization of the polymer and mechanism of polymerization.** Zhou, S.Q.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 1990. 7p. Source: NTIS, PC A02/MF A01.

Pub. in Makromol. Chem., Rapid Commun., Vol. 11, 19-24(1990).

While polymethylhydrosiloxanes are well known poly(carbonsilane)s which possess reactive Si-H bonds are much less common. The proposal by Yajima that poly((methylsilylene)-methylene) is an intermediate in the pyrolytic conversion of poly(dimethylsilane) fibers into silicon carbide fibers has stimulated considerable interest in such carbosilane polymers.

44784 (AD-A-221686/9/XAB) **Composite materials with improved properties in compression: Copolymerization of 1,1-dimethyl-1-silacyclopent-3-ene and 1,1-diphenyl-1-silacyclopent-3-ene. Characterization of copolymer microstructures by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy.** Zhou, Q.; Manuel, G.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 1990. 5p. Source: NTIS, PC A01/MF A01.

1,1-Dimethyl-1-silacyclopent-3-ene and 1,1-diphenyl-1-silacyclopent-3-ene have been copolymerized by treatment with n-butyllithium and hexamethylphosphoramide in THF at -50 C. Random copolymers are formed. The microstructures of these have been characterized by ^{1}H, ^{13}C and ^{29}Si NMR spectroscopy. Thermal stabilities of these copolymers have been determined by thermogravimetric analysis. Their glass transition temperatures have been measured by differential scanning calorimetry. Copolymerization, Dimethyl-1-silacyclopent-3-ene, 1,1-Diphenyl-1-silacyclopent-3-ene, Composite materials.

44785 (AD-A-221688/5/XAB) **Composite materials with improved properties in compression: Anionic polymerization of 1-methyl-1-silacyclopent-3-ene. Characterization of poly(1-methyl-1-sila-cis-pent-3-ene) by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy and mechanism of polymerization.** Zhou, S.Q.; Weber, W.P. University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst. 1990. 4p. Source: NTIS, PC A01/MF A01.

Pub. in Macromolecules, Vol. 23, No. 7, 1915-1917(1990).

1-Methyl-1-silacyclopent-3-ene (I) undergoes anionic ring opening polymerization on treatment with n-butyllithium and hexamethylphosphoramide as cocatalysts in tetrahydrofuran to yield poly(1-methyl-1-sila-cis-pent-3-ene) (II). II has been characterized by infrared and ^{1}H, ^{13}C and ^{29}Si nuclear magnetic resonance spectroscopy as well as by gel permeation chromatography, thermogravimetric analysis and elemental analysis. Due to the low molecular weight of II, ^{1}H, ^{13}C and ^{29}Si NMR spectroscopy affords detailed information that permits characterization of microstructures involved in initiation and termination. End groups have been identified as substituted 1-methyl-1-silacyclopent-3-enes. The mechanism of this polymerization is discussed.

44786 (BNL-44872) **X-ray studies of the liquid/vapor interface: Water and polymer and fatty acid monolayers on water.** Schlossman, M.L. (Harvard Univ., Cambridge, MA (USA)); Schwartz, D.K.; Kawamoto, E.H.; Kellogg, G.J.; Pershan, P.S.; Ocko, B.M.; Kim, M.W.; Chung, T.C. Brookhaven National Lab., Upton, NY (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC02-76CH00016. Grant NSF-DMR-88-12855;Grant NSF-DMR-86-14003. (CONF-891119-135: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90015680. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

X-ray specular reflectivity is used to study the liquid-vapor interface of pure water and of fatty acid and polymer monolayers at that interface. For the pure water surface the reflectivity was measured for three different spectrometer resolutions and simultaneous fits with only one free parameter to all of the data are in excellent agreement with the prediction of capillary wave theory for the RMS surface roughness. Diffuse scattering away from the specular condition, at wavevectors corresponding to those of the capillary waves, yields intensities and line shapes in agreement with theory with no significant adjustable parameters. Reflectivity from separate monolayers of co-poly 1, 2-butadiene/butyl alcohol (50% random substitution) and lignoceric acid ($CH_3(CH_2)_{22}COOH$) at the water/vapor interface are interpreted to obtain profiles of the average electron density $\rho(z)$ as a function of distance z along the surface normal. For the polymer monolayer we find the following: (1) a local maximum in the electron density approximately 10% larger than that of the bulk polymer and (2) the RMS roughness of the vapor/polymer interface agrees with capillary wave theory predictions for the lower surface pressures. For the highest surface pressure the RMS roughness exceeds the value predicted by the capillary wave model. Measurements of reflectivity from a lignoceric acid monolayer, as a function of surface pressure throughout an isotherm (near room temperature), reveal the following behavior: (1) the overall thickness of the monolayer increases with increasing pressure and (2) the head groups occupy a progressively larger region along the surface normal as the pressure increases, indicating that they rearrange normal to the interface. 15 refs., 5 figs., 2 tabs.

44787 (CONF-900368-8) **Synthesis of ultrafine ceramic powders by means of carbon dioxide laser in a flow reactor.** Fantoni, R.; Borsella, E.; Piccirillo, S.; Enzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 12p. From International conference on optical science and engineering; Hague (Netherlands); 12-16 Mar 1990. Order Number DE90514493. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the international congress on optical science & engineering (The Hague, 12-16 Mar 1990).

High purity, ultrafine Si, SiC and Si_3N_4 powders have been produced from gas phase reactants (SiH_4, hydrocarbons, NH_3) in a carbon dioxide laser induced process. Optical on-line diagnostics have been performed to investigate the reaction mechanism in the gas phase. Final product chemical analysis has been employed to check the formation of stoichiometric compounds. Morphologic and crystallographic characterizations of the powders have been performed in order to establish their phase composition, their micro-structure and to understand the growth mechanism which is mostly affected by laser power and residence time.

44788 (CONF-9001104-1) **Proceedings of the first technical symposium on soft x-ray projection lithography: Video guidebook.** Ceglio, N.M. (ed.). Lawrence Livermore National Lab., CA (USA). [1990]. 429p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. From 1. technical symposium on soft x-ray projection lithography; Pacific Grove, CA (USA); Jan 1990. Order Number DE90015353. Source: NTIS, PC A19/MF A01 - OSTI; GPO Dep.

This document is the proceedings for the first technical symposium for the use of soft-x-ray projection lithography (SXPL) in the manufacture of high density integrated circuits. Topics covered were: practical considerations for a SXPL technology; major challenges in SXPL; market prospects for SXPL; practical considerations for SXPL; multilayer technology; x-ray characterization; and multilayer imaging optics. (FSD)

44789 (CONF-9010116-1) **The technical viability of alternative blowing agents in polyisocyanurate roof insulation: Part 3, Acceleration of thermal resistance aging using thin boards.** McElroy, D.L.; Graves, R.S.; Weaver, F.J.; Yarbrough, D.W. Oak Ridge National Lab., TN (USA). [1990]. 27p. Sponsored by U.S. DOE Conservation & Renewable Energy; Environmental Protection Agency. DOE Contract AC05-84OR21400. From Polyurethanes '90 conference; Orlando, FL (USA); 1-4 Oct 1990. Order Number DE90012782. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is a progress report on the initial results of laboratory test on a set of prototypical, experimental, polyisocyanurate (PIR) laminate boardstock produced to evaluate the viability of alternative hydrochlorofluorocarbons (HCFCs) as blowing agents. All boardstock was produced from the same formulation and was not optimized for thermal performance. Boardstock made in the future may differ in performance from this set. Thermal resistance values are reported for PIR boards prepared with CFC-11, HCFC-123, HCFC-141b, and two blends of HCFC-123 and HCFC-141b. The

primary purpose of the laboratory tests is to answer a key question: will foams produced with the alternative blowing agents yield the same outstanding thermal properties obtained with CFC-11? The CFC problem is enormous. Reductions in the production of CFC-11 and CFC-12 may lead to less efficient substitutes and increase annual US energy consumption for building applications alone by one (10^{15}Btu) or more (1). The current effort is a cooperative industry/government program to avoid this undesirable effect by establishing the viability of alternative blowing agents. The research project for CFC alternatives resulted from two workshops that involved participants from industry, government, and academia (2). At the initial workshop the participants prioritized 29 research projects of a CFC research menu. The second workshop focused on a single cooperative project, the long-term performance of substitute insulations containing HCFC-123 and HCFC-141b for roofing applications. 20 refs., 5 figs., 7 tabs.

44790 (CRN-CPR–89-01) **Optimization of the GaAs et GaAs/Si annealing using halogen lamp flashes.** Blanck, H. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1989. 138p. (In French). Order Number DE90514621. Source: NTIS (US Sales Only), PC A07/MF A01.

The aim of the work is to check whether the flash annealing of GaAs and GaAs/Si, using halogen lamps, allows an improvement in the results obtained by usual methods. The electrical activation, defects behavior and results uniformity are studied. The results on the activation and diffusion of implanted impurities are shown to be equivalent to those obtained with classical annealing methods. However, residual impurities (or defects) diffusion phenomena are restrained by the flash annealing technique. The Hall effect cartographic measurements showed an improvement of the uniformity of the implanted coating surface resistance. Flash annealing is a suitable method for the Si activation in GaAs. It allows an improvement of the GaAs results obtained with standard techniques, as well as the formation, by means of ion implantation, of active zones in the GaAs/Si layers.

44791 (DOE/ER/13560–T1) **Investigation of laser diagnostics of PACVD [Plasma Assisted Chemical Vapor Deposition] processes for depositing hard face coatings: Performance report for the period 1 September 1989–31 May 1990.** Roman, W.C. United Technologies Corp., East Hartford, CT (USA). Research Center. 1 Jun 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13560. Order Number DE90016209. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The goal of this project is to improve the understanding of the mechanisms which govern the nonequilibrium reactive plasma of the mechanisms which govern the atomistic or molecular deposition of hard face coatings for erosion resistant applications. The goal is to provide a predictive capability that is severely lacking in the present science base of PACVD processing for depositing hard face coatings. Advanced laser diagnostics will be used to probe the plasma for improving process control. 2 figs.

44792 (DOE/ER/45056–9) **Energy transfer and non-linear optical properties at near ultraviolet wavelengths: Rare earth 4f→5d transitions in crystals and glasses: Progress report, December 1, 1989–November 30, 1990.** Hamilton, D.S. Connecticut Univ., Storrs, CT (USA). Jul 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45056. Order Number DE90015853. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The project has considered several aspects of the optical properties of lanthanide (rare-earth) doped crystals and glasses at near ultraviolet wavelengths. These include two-photon absorption, excited state absorption, excited-state photoionization and color center formation, two-step photoconductivity, optical gain, energy transfer, radiative and nonradiative relaxation and optical grating formation. This report summarizes the research findings of the last two of these projects during the period December 1, 1989 through November 31, 1990. Measurements of the lifetimes of the 5d→4f fluorescence transitions in Ce^{3+}:CaF_2, Ce^{3+}:$LiYF_4$, Ce^{3+}:LaF_3, Ce^{3+}:$Y_3Al_5O_{12}$, Ce^{3+}:$YAlO_3$, Ce^{3+}:YPO_4 Ce^{3+}:fluoroberyllate glass, and Ce^{3+}:silicate glass between 77 K and 1,200 K are used to evaluate the radiative and nonradiative relaxation rates. The model for the nonradiative relaxation involves thermal promotion to higher conduction band states.

44793 (IS-T–1483) **Photoemission and inverse photoemission studies.** Hong, Sayong. Ames Lab., IA (USA). 30 Jul 1990. 72p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE90015416. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

Angle-resolved photoemission spectra (ARPES) and angle-resolved inverse photoemission spectra from single crystals of $CeSn_3$ (111) and $LaSn_3$ (111) were measured and discussed. The results were compared with the calculated band structures and fitted by the Gunnarsson-Schoenhammer (G-S) model. The two-peak structure from the resonance photoemission of $CeSn_3$ was fitted by G-S model well by placing the single f-level at 2.0 eV below the Fermi energy before hybridization. ARPES from both $CeSn_3$ and $LaSn_3$ showed a peak near the Fermi energy without noticeable dispersion. In $LaSn_3$, the experimental $E(\vec{k})$ points below 1.5 eV binding energy from the band mapping agreed well with the calculated band structure. In inverse photoemission, the spectra of both $CeSn_3$ and $LaSn_3$ were totally different from the BIS spectra and gave poor agreement with the band calculations. The results suggested that there were atomic-like 4f states near the Fermi energy. The surface stoichiometry for $CeSn_3$ was measured by AES and the structure was investigated by LEED. The stoichiometry of the $CeSn_3$ (111) surface was close to that of the bulk, and 3-fold-symmetric LEED patterns from both $CeSn_3$ and $LaSn_3$ were observed.

44794 (KCP–613-4326) **Thermal analysis of bismaleimide matrix resins: Final report.** Spieker, D.A. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Jul 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-9009223–2: 19. annual North American thermal analysis society conference, Boston, MA (USA), 23-26 Sep 1990). Order Number DE90016283. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Commercial bismaleimide (BMI) resins for composite applications have mechanical properties with values between those of high temperature epoxies and fully aromatic polyimides. The former have the disadvantage of poor hot-wet strength and the latter have the disadvantages of being difficult to process and costly. Current commercial BMI formulations offer good properties retention under hot/wet conditions, comparative ease of processing, and moderate cost. We have used thermal analysis extensively to study commercial BMI materials. This paper will survey the results to TGA, TMA, and DMA analyses which were performed to characterize the thermal behavior of cured BMI resins. 3 refs., 6 figs.

44795 (LBL–28366) **Microstructure of α-Al base matrix/SiC particulate composites.** Radmilovic, V. (Lawrence Berkeley Lab., CA (USA)); Thomas, G.; Das, S.K. Lawrence Berkeley Lab., CA (USA). Mar 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90014894. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The microstructures of monolithic Al–Fe–V–Si alloy and α-Al base matrix/SiC particulate composites (MMC) have been characterized by conventional and high resolution transmission electron microscopy, microdiffraction and x-ray spectroscopy techniques. Silicide particles of average composition $Al_{12}(Fe,V)_4Si$ are present in both of these materials. These particles are unstable under the electron beam at voltages above 200kV, and exhibit radiation induced disordering. SiC particulates present in the MMC structure are predominantly of the hexagonal 6H polytype, but the hexagonal 5H polytype is also observed. A very thin reaction layer is present between the matrix and SiC particles. No segregation of alloying elements such as Fe, V, or Si at the m/SiC interface has been observed. The second phase present at the α-Al/SiC interface seems to be a disordered silicide. 29 refs., 10 figs.

44796 (LBL–29036) **High resolution transmission electron microscopy of aluminophosphates: Proposed structure for AlPOsub 4-8.** Ulan, J.G. (Lawrence Berkeley Lab., CA (USA)); Gronsky, R.; Szostak, R.; Sorby, K. Lawrence Berkeley Lab., CA (USA). Apr 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900466–75: Spring meeting of the Materials Research Society, San Francisco, CA (USA),

16-21 Apr 1990). Order Number DE90015632. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

VPI-5 transforms to $AlPO_4$-8 under mild thermal treatment (100°C, 18 hrs). HRTEM micrographs, oriented normal to the c axis, show extensive defect-free regions in VPI-5, while slip planes normal to the c axis are found in $AlPO_4$-8. Analysis of the HRTEM data, in conjunction with infrared and thermal analysis, adsorption studies and x-ray powder diffraction, has lead to a proposed structure for $AlPO_4$-8. Though the sheets containing the 18 member rings which define the pores in VPI-5 remain intact in $AlPO_4$-8, reduction in the porosity is attributed to blockages created by the movement of these sheets relative to each other. 8 refs., 7 figs.

44797 (LBL–29206) **Microstructural and phase stability studies of nanometer period metal/carbon multilayer structures for x-ray optics.** Nguyen, Tai D. Lawrence Berkeley Lab., CA (USA). May 1990. 97p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Contract F49620-87-K-0001. Order Number DE90015307. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Multilayer structures of W/C, WC/C, and Ru/C, of various periods were prepared by magnetron sputtering and studied by x-ray diffraction and high-resolution transmission electron microscopy. Studies of microstructures and phases present inside the layers, interfaces, and stability of layered structures and period, of both as-prepared and annealed samples were made. Both as-prepared and annealed WC/C multilayers are predominantly amorphous, while the phases in the W/C depend on the periods. The 2 nm period W/C multilayer remains amorphous after annealing, and the longer periods recrystallize to form W_2C. The layered structures of both W/C and WC/C systems are stable on annealing for periods equal to or larger than 2 nm, while the amorphous Ru-rich layers in the 2 nm period Ru/C multilayer agglomerate upon annealing to form elemental Ru crystallites. Annealing of 1 nm period W/C multilayer also leads to destruction of the layered structures. Longer period Ru/C multilayers show stable layered structures on annealing, and indicate elemental Ru in the Ru-rich layers. Crystalline planes extending into the amorphous layers and grain boundaries in the crystalline layers roughens the interfaces. X-ray measurements show that the multilayer periods expand on annealing for all metal/C multilayers studied. Mechanisms for this expansion is not known, although it seems to be linked to the amorphous C-rich layers. 40 refs., 42 figs., 3 tabs.

44798 (LBL–29214) **Powder processing of aluminides.** Kanou, O. Lawrence Berkeley Lab., CA (USA). May 1990. 61p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90015314. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research was carried out to clarify the process variables in producing Nb_3Al/Nb composite material and to examine the usefulness of Nb phase as a reinforcement in this material. Two processes were investigated and it has been found that the synthesis and hot pressing method was suitable to produce highly densified Nb_3Al/Nb composite material. The hot pressed and heat treated specimen were examined by SEM, EDXS, x-ray diffraction and micro indentation. It has been found that the specimen consisted of a Nb_3Al matrix and a Nb phase. Cracking was strongly influenced by the Nb phase: both crack formation and crack propagation were inhibited by the Nb phases. This effect was more evident in the specimen which contained more Nb phases. It has been concluded that the usefulness of dispersed Nb phase as a reinforcement in the brittle matrix has been proven. 43 refs., 24 figs., 3 tabs.

44799 (LBL–29248) **The scintillation properties of cerium-doped lanthanum fluoride.** Moses, W.W.; Derenzo, S.E. Lawrence Berkeley Lab., CA (USA). May 1990. 18p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC03-76SF00098 ;AC03-82ER13000. Grant P01 25840;Grant R01 CA38086. (CONF-900563–16: 7. symposium on radiation measurements and applications, Ann Arbor, MI (USA), 21-24 May 1990). Order Number DE90015466. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We report on the scintillation properties of cerium-doped lanthanum fluoride (LaF_3), a newly discovered dense (5.9 g/cm^3) heavy atom scintillator. We have investigated four dopant concentrations (0.01%, 1%, 10% and 50% mole fraction of CeF_3), measuring the emission spectrum, light output, and decay time distribution. The light output increases with increasing cerium concentration until a maximum of 2200 photons/MeV is reached at 10% CeF_3, then decreases to 1900 photons/MeV at 50% CeF_3. The emission spectrum depends on concentration, but consists of a pair of peaks centered at approximately 300 nm and 350 nm, with the lower cerium concentrations having a greater fraction of 300 nm emissions. The decay time distribution is well described by the sum of 3 exponential components: 3.0 ns, 26.5 ns, and a dopant dependent long component that varies between 185 ns and 275 ns. The fraction of the 3.0 ns fast component increases from 10% at 50% cerium to 15% at 1% cerium and the fraction of the long component increases from 3% at 50% cerium to 21% at 1% cerium. There is hope that a different cerium doping fraction or different host crystal would increase the intensity of these 3 ns emissions. 13 refs., 6 figs., 1 tab.

44800 (N–90-22651, pp. 24) **Environment enhanced fatigue of advanced aluminum alloys and composites.** Slavik, D. C.; Gangloff, R. P. Virginia Univ., Charlottesville, VA (USA). Jun 1990. (NASA-CR–182607;NAS–1.26:182607;UVA–528266/MS90/106). In *NASA-UVA light aerospace alloy and structures technology program.* Source: NTIS, PC A17/MF A03.

The objective is to characterize and understand the environmental fatigue crack propagation behavior of advanced, high stiffness and strength, aluminum alloys and metal matrix composites. Those gases and aqueous electrolytes which are capable of producing atomic hydrogen by reactions on clean crack surfaces are emphasized. Characterizations of the behavior of new materials are sought to provide data for damage tolerant component life prediction. Mechanistic models are sought for crack tip damage processes which are generally applicable to structural aluminum alloys. Such models will enable predictions of cracking behavior outside of the data, metallurgical improvements in material cracking resistance, and insight on hydrogen compatibility.

44801 (N–90-22651, pp. 26) **Investigation of the reaction kinetics between SIC fibers and selectively alloyed titanium matrix composites and determination of their mechanical properties.** Gundel, D.B.; Wawner, F.E. Jr. Virginia Univ., Charlottesville, VA (USA). Jun 1990. (NASA-CR–182607;NAS–1.26:182607;UVA–528266/MS90/106). In *NASA-UVA light aerospace alloy and structures technology program.* Source: NTIS, PC A17/MF A03.

During high temperature exposure, an interfacial reaction occurs between SiC fiber reinforcement and titanium matrices which can be detrimental to the mechanical properties of the composite. The reaction kinetics between SCS-6 fibers and Ti-1100 were determined at 800 to 1000 C and found to be slower than those of other currently used titanium alloys (Ti-15-3, Ti-6-4). The experimentally determined reaction kinetics for Ti-1100 were extrapolated to 700 C and found to accurately predict reaction zone size after 1000 hours of exposure. Predictions of the time to consume the surface layer on the SCS-6 and SCS-9 fibers were made in an effort to estimate the time that the fiber will retain its strength in Ti-1100 during isothermal exposure at high temperatures. Using this approach, the strength of an SCS-6 fiber in Ti-1100 should be retained for over 20,000 hours at isothermal exposures less than 800 C. Strength predictions using the rule of mixtures for a unidirectional Ti-1100/SCS-6 composite are presented for short term exposures up to 700 C. Room temperature tests of an as-fabricated 20 volume percent fiber/Ti-1100 composite yielded a UTS of 226 ksi (1490 MPa) which is close to that predicted by the ROM.

44802 (N–90-22651, pp. 31) **Inelastic response of metal matrix composites under biaxial loading.** Mirzadeh, F.; Pindera, M.; Herakovich, C.T. Virginia Univ., Charlottesville, VA (USA). Jun 1990. (NASA-CR–182607;NAS–1.26:182607;UVA–528266/MS90/106). In *NASA-UVA light aerospace alloy and structures technology program.* Source: NTIS, PC A17/MF A03.

Elements of the analytical/experimental program to characterize the response of silicon carbide titanium (SCS-6/Ti-15-3) composite tubes under biaxial loading are outlined. The analytical program

comprises prediction of initial yielding and subsequent inelastic response of unidirectional and angle-ply silicon carbide titanium tubes using a combined micromechanics approach and laminate analysis. The micromechanics approach is based on the method of cells model and has the capability of generating the effective thermomechanical response of metal matrix composites in the linear and inelastic region in the presence of temperature and time-dependent properties of the individual constituents and imperfect bonding on the initial yield surfaces and inelastic response of (0) and (+ or - 45)sub s SCS-6/Ti-15-3 laminates loaded by different combinations of stresses. The generated analytical predictions will be compared with the experimental results. The experimental program comprises generation of initial yield surfaces, subsequent stress-strain curves and determination of failure loads of the SCS-6/Ti-15-3 tubes under selected loading conditions. The results of the analytical investigation are employed to define the actual loading paths for the experimental program. A brief overview of the experimental methodology is given. This includes the test capabilities of the Composite Mechanics Laboratory at the University of Virginia, the SCS-6/Ti-15-3 composite tubes secured from McDonnell Douglas Corporation, a text fixture specifically developed for combined axial-torsional loading, and the MTS combined axial-torsion loader that will be employed in the actual testing.

44803 (NDA/NF–90-03379) **Utilization of Newfoundland aggregates to produce concrete for offshore structures.** Davis, B.F. Nolan, Davis and Associates Ltd., St. John's, NF (Canada). Nov 1989. 85p. Contract EMR 69174-01-SQ. (MICROLOG–90-03379). Source: PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The anticipated construction of offshore oil drilling platforms in the Hibernia field has led to interest in the potential for producing high strength concrete. A test program was conducted to provide basic trial mix data using materials available in Newfoundland. Although aimed at the offshore questions, it provides data also for other high strength concrete considerations. The program consisted of initially identifying three aggregate sources (granite, sandstone, grave) with good potential for the production of high strength concrete, developing a specification for the aggregate and procuring and processing chosen aggregates to the specification. The processed aggregates were then used in the preparation of a series of 9 trial mixes which included cementitious materials and admixtures readily available in Newfoundland. The trial mixes were tested for durability, strength and other properties. Results indicate that it would be possible to make concrete meeting requirements for 70 megapascals at 91 days using any of the 3 aggregates. Compressive strength performance of concrete mixes using the aggregates is similar. The addition of 7% silica fume increases compressive strength by approximately 14% at 91 days. The main area of concern would be freeze-thaw durability where only the sandstone aggregate concrete performed well. Flexural strength and splitting tensile strength results for each of the three aggregate concretes were comparable to values estimated using the American Concrete Institute. The sandstone aggregate emerges as having slightly superior overall performance. In the plastic concrete, the batches displayed a lower variability and the hardened concrete characteristics were comparable to, or superior to, those of concretes made with the gravel and granite aggregates. 3 refs., 18 figs., 15 tabs.

44804 (OH/RD–89-184-K) **Wawaltin GS [generating station] West Dyke rehabilitation test results of roller compacted concrete cores.** Mukherjee, P.K. Ontario Hydro Research Div., Toronto, ON (Canada). 7 Dec 1989. 22p. (MICROLOG–90-03997). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

A Roller Compacted Concrete (RRC) system was proposed for the rehabilitation of Wawaitin (Ontario) Generating Station control dam. Prior to the implementation of the system, trial strips were laid with three different mixes of suitable consistency. Conventional earth moving equipment and vibratory rollers were used to spread and compact the layers of RCC. RCC core samples were obtained at various ages up to 6 months, and tests were carried out to determine physical properties. Although limited in scope, the test results are promising in terms of the concrete quality, field compaction method, strength, and density of the in-situ concrete. Further work is required with job site materials to determine long-term durability properties. 9 figs., 9 tabs.

44805 (ONRFE-SCI-INFO-BULL–13(4)88) **ONR Far East Scientific Information Bulletin, Volume 13, No. 4.** Kawano, S. Office of Naval Research Liaison Office, Far East, APO San Francisco, CA 96503 (USA). Dec 1988. 94p. Source: NTIS, PC A05/MF A01.

Quarterly Report, Oct. - Dec. 1988.

Articles covering recent developments in Far Eastern (particularly Japanese) scientific research are presented. Topics addresed include: high temperature superconducting films, technology transfer; metallic superlattices, Kuroshio current; La_2CuO_4 superconductors; computational fluid dynamics; supercomputers; and materials processing.

44806 (ORNL/ATD–33) **Composite heat damage: Part 1, Mechanical testing of IM6/3501-6 laminates; Part 2, Nondestructive evaluation studies of IM6/3501-6 laminates.** Frame, B.J. (Oak Ridge National Lab., TN (USA)); Janke, C.J.; Simpson, W.A. Jr.; Ziegler, R.E.; Philpot, H.E. Oak Ridge National Lab., TN (USA); Oak Ridge Gaseous Diffusion Plant, TN (USA). May 1990. 165p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016207. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The matrix-dominated mechanical properties of heat-damaged and non-heat-damaged IM6/3501-6 laminates are presented in Part 1. "Wet" and "dry" preconditioned laminates were exposed on one side to temperatures ranging from room temperature to 750°F for 0 to 60 min and subsequently tested at ambient conditions in accordance with American Society for Testing and Materials (ASTM) standards, including compression – ASTM D3410-87, flexure – ASTM D790-87, short-beam shear – ASTM D2344-84, and shore-D hardness – ASTM D2240-86. Shore-D-hardness testing was a poor indicator of mechanical strength loss. Heat-damaged 0° compression specimens were the least sensitive to strength degradation compared with the other properties that were tested. Heat-damaged specimens that were tested in shear and flexure suffered significant strength reduction and degradation at exposure temperatures $\geq$ 550°F for 5 to 60 min. The percent weight loss, micrometer measurements, and visual differences of IM6/3501-6 specimens as a function of elevated temperature exposure are reported. The results of heat-degradation effects on IM6/3501-6 specimens utilizing various nondestructive evaluation (NDE) techniques, including digital pulse (broadband), tone burst (monochromatic), ultrasonic color C scanning, and "leaky" Lamb waves are presented in Part 2. Preliminary results indicated that the "leaky" Lamb-wave technique appeared to be the most promising NDE tool for characterizing the level of heat damage in IM6/3501-6 laminates. This technique is capable of detecting relative changes in a given sample at a particular location; however, it does not appear to have the capability of providing absolute results on random samples.

44807 (PB–90-223819/XAB) **Damage mechanics of composite materials 1: Measurement of damage and strength. Technical report.** Kortschot, M.T.; Beaumont, P.W.R. Cambridge Univ. (UK). Dept. of Engineering. 1990. 28p. (CUED/C/MATS/TR–164). Source: NTIS, PC EE06/MF E06.

A new approach for modelling the strength of notched composites has been developed. The approach is based on the assumption that subcritical damage modifies the notch tip stress field and that the state of subcritical damage just prior to failure, referred to as the terminal damage state (TDS), must have a significant influence on notched strength. The TDS was monitored for a wide range of cross-ply graphite reinforced epoxy specimens using real-time radiography. A finite element model incorporating the TDS was used to determine the modified notch tip stress field. A simple tensile stress failure criterion has been found to predict failure very well provided that the effect of subcritical damage is considered in this way. The effect of both lay-up and notch size on

strength can be entirely accounted for by the effect the parameters have on the terminal damage state. In the first paper of a four-part series, radiographs of approximately 60 specimens have been used to characterize the notch tip damage zone and to establish a qualitative relationship between terminal damage and notched strength.

44808 (PB–90-223868/XAB) **Damage-based notched-strength modeling: A summary.** Kortschot, M.T.; Beaumont, P.W.R. Cambridge Univ. (UK). Dept. of Engineering. 1989. 44p. (CUED/C-MATS/TR–168). Source: NTIS, PC EE06/MF E06.

The effect of subcritical damage on the notched strength of cross-ply graphite-epoxy specimens has been studied using 914C/T300 laminates of the family (90j/0j)ns (j = 1,2, n = 1,2,4). Damage was monitored using quasi-real-time radiography and dynamic scanning electron microscopy. In addition, the strain field in the vicinity of the notch tip was mapped using a high resolution optical technique. A strong relationship between subcritical damage and notched strength is evident in all of the data. A theoretical model which is based on observed damage is briefly summarized. Finite element analysis was used to determine the effect of splitting and delamination on the stress distribution in the 0(sup 0) ply. All specimens were found to fail when the maximum stress in the 0(sup 0) ply equalled the strength of the ply. The model predicts the effect of both notch size and lay-up on strength without the need for empirical parameters.

44809 (PB–90-873332/XAB) **Friction material patents. November 1971-May 1990 (A Bibliography from the US Patent data base). Report for November 1971-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 52p. Source: NTISPC N01/MF N01.

This bibliography contains citations of selected patents concerning materials compositions used in high-heat, high-wear engineering applications. Polymer-based materials, modified by the addition of steel fibers, woven carbon fabric, mill scale, organic fillers of animal origin, iron powders, and metal flame coatings are among those described. Methods used in securing external adhesion of the friction materials to brake surfaces, and internal cohesion of various constituents are discussed. Considerable attention is given to automotive and railroad braking applications, and to asbestos-free materials. (Contains 125 citations fully indexed and including a title list.)

44810 (SAND–90-0109C) **Kinetics and structure of silicate sol-gels.** Assink, R.A.; Brinker, C.J.; Kay, B.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9007147–1: IUPAC symposium on macrommolecules, Montreal (Canada), 8-13 Jul 1990). Order Number DE90015702. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The structure of a silicate sol-gel derived material depends on the nature of its reaction kinetics. The chemical state of the silicate sol-gel is characterized by both the functional group concentrations and the distribution of the functional groups about a single silicon atom. ^{29}Si nuclear magnetic resonance (NMR) spectroscopy provides a way to quantitatively determine these concentrations and distributions as a function of time during the reaction. During the early stages of the sol-gel reaction, the distribution of hydrolyzed species enables one to calculate the relative rates of hydrolysis. During the intermediate stages of the reaction, the rate of formation of various condensed species enables one to determine the reaction rate constants for both water-producing and alcohol-producing condensation. The chemical bonding of sol-gel derived solid materials can be determined by direct polarization NMR combined with magic angle spinning techniques. These capabilities provide a valuable tool for studying the relationships between the reaction conditions, the chemical kinetics and the resulting structure of the sol-gel derived material. 8 refs., 4 figs.

44811 (SAND–90-2058C) **Anomalous dispersion as a phase-matching technique for second harmonic generation.** Cahill, P.A. (Sandia National Labs., Albuquerque, NM (USA)); Singer, K.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010170–1: International symposium on nonlinear optical materials, El Paso, TX (USA), 28 Oct - 2 nov 1990). Order Number DE90015696. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Anomalous dispersion (the decrease in refractive index which is associated with absorption) can be used to produce a phase-matched condition for second harmonic generation. This process also gives rise to large increases in the useful second order hyperpolarizability. A new, soluble NLO dye with exceptionally low absorption near 400 nm has been used for anomalous dispersion phase-matching studies in thin films.

44812 (UCRL–102845-Rev.1) **Lapping: Polishing and shear mode grinding: Revision 1.** Brown, N.J. Lawrence Livermore National Lab., CA (USA). Feb 1990. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006252–1-Rev.1: OSA science of optical finishing workshop, Monterey, CA (USA), 10-12 Jun 1990). Order Number DE90015188. Source: NTIS, PC A03/MF A01 - OSTI.

It is the thesis of this paper that shear mode grinding (SMG), (ductile grinding, nanogrinding, fractureless grinding) is just a particular form of polishing. It may be unique in that it can involve a hard wheel of very precise dimensions compared to the soft laps usually used in polishing. Such a wheel would permit the fabrication of a precision surface on a brittle material such as glass at a precisely located and oriented position on a part. The technological and economic consequences of such a process seem important but the technical obstacles to implementing the technique are for the moment formidable. It is in production in Japan. This paper provides a bit of understanding of that process obtained by making an end run around the obstacles to view the process from the vantage point of lapping. The paper will lay out some of the concepts and terminology necessary to understand the papers that have supplied the real labor to get us to this point. It will refer to parts of this work briefly in passing so the reader who needs the details knows where to look, and for what, in the bibliography appended. 32 refs., 5 figs.

44813 (UM-P–89/105) **Heavy-ion irradiation tracks in zircon.** Bursill, L.A.; Braunshausen, G. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 44p. Order Number DE90636629. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Heavy-ion irradiation (14 MeV/u Pb ions) of zircon crystals gives rise to linear latent tracks of 80×10^{-10} m diameter and length 140 μm. Direct observation of the track core, by high-voltage high-resolution electron microscopy at atomic resolution, reveals a core having roughly circular cross-section, with some facetting of the core/matrix interface on [101] planes of zircon. The core diameter appears quite uniform. Conventional transmission electron microscopy (bright- and dark-field imaging) reveals an elastic strain field extending for a short distance into the zircon matrix. This appears to drop off more rapidly with distance, say $1/R^2$, than do dislocation strain fields ($\approx 1/R$). Analysis of the various contrast mechanisms yields the result that the core is essentially amorphous. The observations confirm directly earlier conclusions based on track etching and electrical conductivity measurements, that the irradiation damage is confirmed to a 50-100 Aangstroem core region of atomically-disordered material, with virtually no damage outside this region. Mechanisms for track production are discussed briefly, but it is concluded that the problem, which is now defined by this structural analysis, has not been fully-appreciated by condensed matter physicists. In particular a damage confinement mechanism is required, which is not intuitively obvious. Some tentative suggestions along this direction are proposed. 33 refs., 9 figs.

44814 Friction and wear transitions of materials: Break-in, run-in, wear-in. Blau, P.J. (Oak Ridge National Lab., TN (USA)). 476p. Noyes Publications, Park Ridge, NJ (USA) (1989).

This book emphasizes transitions and break-in phenomena. It begins with a general overview of the broad field of tribology, particularly describing sources of information and discussing the inconsistencies in friction and wear terminology. Chapters describe friction and wear in general, emphasizing not theory, but examples of materials behavior, important variables which affect transitions in friction and wear, considerations in tribotesting materials, and reporting of friction and wear data. The book discusses friction and wear transitions, including transitions mapping, attributes of transitions, factors influencing transitions, and transitions control. Sample industrial running-in procedures are provided. The author's sliding

friction transitions model is described, and a new approach to understanding complex tribosystems called tribocommunications is developed.

44815 In-situ IR spectroscopy of an oxygen-acetylene flame during diamond film growth. Morrison, P.W. Jr. (Advanced Fuel Research, Inc., Hartford, CT (USA)); Markham, J.R.; Cosgrove, J.E.; Solomon, P.R. pp. 3-4, Paper I & EC 3 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). DOE Contract AC01-89ER80815. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Recently, researchers have discovered that an oxygen-acetylene torch can deposit diamond films on a cooled substrate placed within the flame. Flame chemical vapor deposition (CVD) deposits polycrystalline films at rates approaching 100 μ/hr. Compared to alternative deposition methods (microwave CVD and hot filament CVD), the understanding of flame CVD is largely unknown. This research employs Fourier Transform Infrared (FT-IR) spectroscopy to elucidate the gas phase chemistry of flame CVD of diamond.

44816 Methods of determining thin film stress. Thomas, N.L. (Lawrence Livermore National Lab., CA (USA)). pp. 76-77 of Optical interference coatings, 1988 technical digest series: Volume 6. Optical Society of America, Washington, DC (USA) (1988). (CONF-880434–: 4. topical meeting on optical interference coatings, Tucson, AZ (USA), 12-15 Apr 1988).

According to this paper, thin film stress can play an important part in the fabrication of flat media on thin substrates, and can cause unwanted deformations and failure. The stress parameter has been shown to be adjustable by varying the deposition parameters during thermal evaporation or sputtering. For example, ion assisted reactive evaporation is a deposition technique which has been shown to be useful in controlling stress, in addition to other thin film parameters. The successful application of these techniques requires that the stress be monitored, in situ, during a coating run, or, by means of a piggy-backed stress monitor disk whose curvature is measured after the coating run.

44817 Sintering microstructures: Instabilities and the interdependence of mass transport mechanisms. Carter, W.C. (Lawrence Berkeley Lab., CA (USA). Center for Advanced Materials); Cannon, R.M. pp. 137-163 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract AC03-76SF00098. (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

The thermodynamics of processes which can dehomogenize a sintering system are investigated by exact calculation of the driving forces and geometry of a linear row of sintering particles. The effects of diffusional transport coefficients, applied forces, and dihedral angle on the evolution of microstructure can be understood. Nondensifying mass transport mechanisms (e.g., surface or vapor transport) produce microstructural evolutions distinguished from those derived from densifying mechanisms (e.g., lattice or boundary diffusion). Conditions for the occurrence of coarsening, differential densification, and combinations thereof, are calculated. The conditions for rupture of a constrained chain emerge in addition to the amounts of mass transport which precipitates rupture. Regimes where a sintering system is relatively stable to heterogeneities exist as well as regimes for which a system is very unstable.

44818 Microstructural characterization of $CuGaSe_2$ thin films by x-ray diffraction. Albin, D. (Solar Energy Research Inst., Golden, CO (US)); Noufi, R.; Tuttle, J.; Risbud, S.H. pp. 141-148 of Advanced characterization techniques for ceramics: Volume 5. Young, W.S.; McVay, G.L.; Pike, G.E. American Ceramic Society Inc., Columbus, OH (USA) (1988). DOE Contract AC02-83CH10093. (CONF-8810195–: 41. Pacific coast regional meeting of the American Ceramic Society, San Francisco, CA (USA), 24-26 Oct 1988).

This paper presents a microstructural study of $CuGaSe_2$ thin films deposited by multi-source evaporation from the constituent elements. The authors concentrate on results obtained by XRD with emphasis on crystallographic structure, defect chemistry, and phase separation.

44819 Simulation and theory of abnormal grain growth: Anisotropic grain boundary mobilities. Rollett, A.D. (Los Alamos National Lab., NM (USA)); Srolvitz, D.J.; Anderson, M.P. pp. 229-239 of Sintering of advanced ceramics: Volume 7. Handwerker, C.A.; Blendell, J.E.; Kaysser, W. American Ceramic Society Inc., Columbus, OH (USA) (1990). DOE Contract W-7405-ENG-36. (CONF-880504–: 90. annual meeting of the American Ceramic Society, Cincinnati, OH (USA), 1-5 May 1988).

Abnormal grain growth has been studied by means of a computer-based Monte Carlo simulation. This model has been shown to reproduce many of the essential features of normal grain growth. The simulations presented in this work are based on a modified model in which two distinct types of grains are presented. These two grain types might correspond to two components of different crystallographic orientation, for example. This results in three classes of grain boundaries: between unlike types, between grains of the first type, and between grains of the second type, to which different grain boundary energies of different mobilities can be assigned. Simulations were performed with a single grain of the first type embedded in a matrix of grains of the second type. Anisotropic grain boundary mobilities were modeled by assigning a lower mobility to boundaries between grains of like type than to boundaries between unlike type. The extent of abnormal grain growth varied with the ratio of mobilities and it is tentatively concluded that there is a limiting ratio of size of the abnormal grain relative to the matrix. A simple treatment of anisotropic grain boundary mobility was developed by modifying Hillert's grain growth model. This theoretical treatment also produced a limiting ratio of relative size that is a simple function of the mobility ratio.

44820 Graded-codeposited ZrC-BN coating for the thermal protection of carbon-carbon composites. Kowbel, W. pp. 290-308 of Ceramic materials and components for engines; Proceedings of the Third International Symposium, Las Vegas, NV, Nov. 27-30, 1988. Tennery, V.J. American Ceramic Society, Inc., Westerville, OH (US) (1989). (CONF-881125–: 3. international symposium on ceramic materials and components for engines, Las Vegas, NV (USA), 27-30 Nov 1988).

Current aerospace and military applications of carbon-carbon composites include rocket nozzles, reentry components, and aircraft brake disks. Potential uses have been identified in future-generation of military aircraft, advanced missile systems, and a variety of hypersonic aerospace vehicles. All of these applications take advantage of the high-temperature capabilities of carbon and the benefits of fiber reinforcements. This work presents a graded-composite coatings system able to provide thermal protection above 1500 C. The total coating is comprised of the diamondlike substrate infiltration, boron ion implantation of substrate, ZrC-C graded coating, and ZrC-BN composite coating. The microstructure, composition, and mechanical properties were controlled by two variables: input gas ratio and temperature. The SOLGASMIX-PV program was used to find partial pressure for deposition which makes it possible to obtain ZrC-C and ZrC-BN two-phase fields. 15 refs.

44821 Pore structure, permeability, and chloride diffusion in fly ash- and slag-containing pastes and mortars. Malek, R.I.A. (Pennsylvania State Univ., University Park, PA (USA). Materials Research Lab.); Roy, D.M.; Fang, Y. pp. 403-410 of Pore structure and permeability of cementitious materials: Volume 137. Roberts, L.R.; Skalny, J.P. Materials Research Society, Pittsburgh, PA (USA) (1989). (CONF-881155–: Fall meeting of the Materials Research Society, Boston, MA (USA), 28 Nov - 3 dec 1988).

This paper investigates the transport of ions through cement pastes and mortars with variable contents of fly ashes and granulated blast-furnace slag from different sources and with variable composition. The research included the determination of chloride diffusion rate and chloride permeability in relation to microstructure development. The median pore size generally was much diminished in mature blended material compared with Portland cement (PC) pastes and mortars. It appears that, at the same age, a finer microstructure is generally developed in blended specimens compared to PC specimens. Also, it was found that the microstructure

approaches a limiting value at longer ages of hydration. That limiting value may be reached at earlier ages with the blends. The chloride diffusion rates and permeabilities in the blends were significantly lower than PC mixes. A comparison between the blends containing fly ashes and those containing slag has been made.

44822 Formation of low dislocation density silicon-on-insulator by a single implantation and annealing. EL-Ghor, M.K. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6024 (USA)); Pennycook, S.J.; Namavar, F.; Karam, N.H. *Applied Physics Letters (USA)*, 57(2): 156-159 (9 Jul 1990). DOE Contract AC05-84OR21400.

High quality silicon-on-insulator structures have been formed with dislocation densities in the top silicon layer below 10^4 cm^{-2} by oxygen implantation and one-step annealing at 1300 °C for 6 h. Careful control of the implantation conditions is required in order to produce a high density of cavities in the top silicon layer. These cavities provide a stress-free sink for silicon and oxygen interstitials, reducing the point-defect supersaturations and, therefore, the nucleation and growth of oxide precipitates and dislocation loops. They also provide an internal surface which blocks free propagation of dislocation loops to the surface avoiding the formation of threading dislocations. With continued annealing, both the cavities and the oxide precipitates eventually dissolve, leaving a high quality silicon surface layer with a very low dislocation density.

44823 Chemical kinetics of hydrogen and (111) Si-SiO_2 interface defects. Brower, K.L. (Sandia National Laboratory, Albuquerque, New Mexico 87185 (USA)); Myers, S.M. *Applied Physics Letters (USA)*, 57(2): 162-164 (9 Jul 1990). DOE Contract AC04-76DP00789.

Electron paramagnetic resonance (EPR) measurements and theoretical considerations have yielded a unified model for the hydrogen chemistry of silicon dangling bond P_b defects at the (111) Si-SiO_2 interface. Previous EPR measurements indicated that passivation of P_b centers with H_2 proceeds by the reaction $H_2+P_b \rightarrow HP_b+H$ with an activation energy of 1.66±0.06 eV. New EPR studies reported here show that HP_b centers dissociate by the reaction $HP_b \rightarrow P_b+H$ with an activation energy of 2.56±0.06 eV. When combined, these two reactions yield $H_2 \rightarrow H+H$, which in vacuum requires an energy input of 4.52 eV. Comparison of these energies indicates that the reverse reactions $H+HP_b \rightarrow P_b+H_2$ and $H+P_b \rightarrow HP_b$ occur with essentially no energy barrier and are controlled by the local availability of atomic hydrogen.

44824 Phase diagram of a lipid monolayer on the surface of water. Lin, B. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208 (USA)); Shih, M.C.; Bohanon, T.M.; Ice, G.E.; Dutta, P. *Physical Review Letters (USA)*, 65(2): 191-194 (9 Jul 1990). DOE Contract FG02-84ER45125.

The monolayer isotherms of heneicosanoic acid show a variety of features in the range 1–8 °C; such features are often assumed to be solid-fluid or fluid-fluid transitions. Using x-ray diffraction (and searching for in-plane and off-plane peaks) we find (a) two distinct distorted-hexagonal (DH) solids at high pressures, both with essentially vertical chains; (b) two distinct tilted-DH solids at intermediate pressures; and (c) an expanded solid at the lowest pressures. All "plateaus" in these isotherms are in-plane structural transitions; all "kinks" are solid-solid tilting transitions.

44825 Uniaxial lattice expansion of self-ion-implanted Si. Holland, O.W. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (USA)); Budai, J.D.; White, C.W. *Applied Physics Letters (USA)*, 57(3): 243-245 (16 Jul 1990). DOE Contract AC05-84OR21400.

Lattice strain in self-ion-implanted Si is investigated. Under certain irradiation conditions, a unique strain field is shown to form over the range of the ions. This strain field is one-dimensional and expands the lattice along the direction normal to the surface of the crystal. This phenomena is investigated over a wide range of ion energy (100 keV and 1.25 MeV) and at different implantation temperatures. The presence of uniaxial strain is shown to correlate with a particular damage morphology in Si. This ion-induced morphology and the irradiation conditions under which it forms are discussed, as well as the mechanism which leads to uniaxial, lattice strain. Both ion channeling and x-ray diffraction analyses are used to characterize the strain field.

44826 Effect of photodeposited iron oxide and tin oxide on the consolidation of porous Vycor glass. Mendoza, E.A. (Departments of Chemistry and Physics, Queens College, Flushing, New York 11367 (USA)); Sunil, D.; Wolkow, E.; Gafney, H.D.; Rafailovich, M.H.; Sokolov, J.; Long, G.G.; Jemian, P.R.; Schwartz, S.A.; Wilkens, B.J. *Applied Physics Letters (USA)*, 57(3): 209-211 (16 Jul 1990). DOE Contract AC02-76CH00016.

Iron oxide and tin oxide have been photodeposited in porous Vycor glass and examined before and after consolidation of the glass. Scanning electron microscopy reveals that the iron oxide particles are larger than the tin oxide particles. However, small-angle x-ray scattering and Rutherford backscattering show that the glass consolidates about the iron oxide but not about the tin oxide. Photodeposition of tin oxide, which appears to chemically modify the glass surface and to prevent its consolidation, offers a means of producing highly resolved regions of porosity in the otherwise consolidated glass.

44827 q_1 charge-density wave in $NbSe_3$. Moudden, A.H.; Axe, J.D.; Monceau, P. *Physical Review Letters (USA)*, 65(2): 223-226 (9 Jul 1990). DOE Contract AC02-76CH00016.

Using synchrotron x-ray-scattering measurements on $NbSe_3$, we show that the diffuse scattering associated with the q_1 charge-density-wave fluctiations are rods perpendicular to the (*a*,*b*) planes reflecting a 2D regime of fluctuations with an in-plane anisotropy $\xi_b^*/\xi_a^* \approx 3.5 \pm 0.5$. The plane of the 2D fluctuations is likely to be formed by the chains with the shortest Se-Se pairing. The 3D coupling sets in within 2 K above the transition temperature $T_1 \approx 150$ K with an out-of-plane anisotropy $\xi_b^*/\xi_c^* = 27 \pm 2$. q_1 has a significant temperature variation from about 0.2445(1) at T_1 to 0.2411(1) at about 80 K and then remians constant to the lowest temperatures. Upon cooling, the incommensurate wave vector is driven far away from the commensurate value 1/4. No anomaly in either the amplitude or the phase of q_1 is observed at the second charge-density-wave transition.

44828 In situ photodegradation of $SnBr_2$. Force, R.K. (Univ. of Rhode Island, Kingston (USA)); Fessehaie, M.G.; Grosso, R.P.; Laliberte, J.M.; McCLain, S.; Willis, W.S.; Suib, S.L. *Chemistry of Materials (USA)*, 2(3): 268-273 (May-Jun 1990).

The in situ photodegradation of $SnBr_2$ has been studied under vacuum or under nitrogen with X-ray photoelectron spectroscopy, residual gas analysis, photogravimetric analysis, and thermogravimetric analysis. The authors results suggest that the photodegradation process is quite complex and occurs through several pathways. The initial step involves the photoexcitation of $SnBr_2$ with evolved gaseous species containing SnBr(g) and Br(g) as major decomposition products. In addition, water molecules on the $SnBr_2$ form SnO(s) and HBr. Minor secondary pathways for the decomposition involve the dissociation of HBr and SnBr(g). In addition, some metallic Sn is formed during photolysis.

44829 Defect level identification in $CuInSe_2$ from photoluminescence studies. Dagan, G. (Weizmann Institute of Science, Rehovot (Israel)); Cahen, D.; Abou-Elfotouh, F.; Dunlavy, D.J.; Matson, R.J. *Chemistry of Materials (USA)*, 2(3): 286-293 (May-Jun 1990).

By correlating photoluminescence data with the electronic properties, stoichiometry, and chemical diffusion coefficients (of Cu) for a number of single-crystal samples, the authors arrive at a chemically and physically consistent interpretation of luminescent transitions in $CuInSe_2$. This interpretation involves point defect chemical assignments to the electron energy levels that are involved in these transitions. Thus the copper vacancy, V_{Cu}, is identified as a defect that is mainly responsible for Cu diffusion in this material. The electrochemical potential of the electron involved in the $V_{Cu}^{x} + e^{-} = V_{Cu}'$ reaction is found to be ca. 40 meV above the valence band.

44830 Atomic structure of twins in GaAs. Lee, B. (Department of Metallurgical Engineering, Chonnam National University, Kwangju (Korea)); Lee, J.Y.; Bourret, E.D. *Applied Physics Letters (USA)*, 57(4): 346-347 (23 Jul 1990).

Two types of twins with different atomic structure may exist in GaAs: rotation type and reflection type. A selective chemical etching technique was employed to clarify which of these two twin types occurs in practical GaAs crystals. Twins in an As-rich horizontal Bridgman (HB) GaAs, a Ga-rich HB GaAs, and a liquid-encapsulated Czochralski GaAs were studied, and the results showed that all of the studied twins were rotation type. This suggests that the bonding configuration at the twin plane is a more important factor than stoichiometry of the crystal, in determining the type of twins in GaAs.

44831 Fluctuations and thermodynamics of the charge-density-wave phase transition. Kwok, R.S. (Department of Physics, University of California, Los Angeles, CA (USA)); Gruner, G.; Brown, S.E. *Physical Review Letters (USA)*, 65(3): 365-368 (16 Jul 1990).

We present results on the resistivity ρ, specific heat C_p, and susceptibility χ of $K_{0.3}MoO_3$ near the Peierls transition T_p at 180 K. Our resistivity measurements demonstrate that fluctuations intrinsic to the material persist over a temperature interval that is at least 30 K wide. Associated with the large fluctuations is en enhanced specific-heat anomaly that we analyze in terms of the short coherence lengths characteristic of many Peierls systems. We find a scaling relation between the spin susceptibility and the specific heat that covers the intrinsic fluctuation regime.

44832 Special quasirandom structures. Zunger, A. (Solar Energy Research Institute, Golden, Colorado 80401 (USA)); Wei, S.; Ferreira, L.G.; Bernard, J.E. *Physical Review Letters (USA)*, 65(3): 353-356 (16 Jul 1990). DOE Contract AC02-77CH00178.

Structural models used in calculations of properties of substitutionally random $A_{1-x}B_x$ alloys are usually constructed by randomly occupying each of the N sites of a periodic cell by A or B. We show that it is possible to design "special quasirandom structures" (SQS's) that mimic for small N (even N=8) the first few, physically most relevant radial correlation functions of a perfectly random structure far better than the standard technique does. We demonstrate the usefulness of these SQS's by calculating optical and thermodynamic properties of a number of semiconductor alloys in the local-density formalism.

44833 Vacuum ultraviolet radiation/atomic oxygen synergism in materials reactivity. Koontz, S. (NASA, Johnson Space Center, Houston, TX (USA)); Leger, L.; Albyn, K.; Cross, J. *Journal of Spacecraft and Rockets (USA)*, 27: 346-348 (Jun 1990).

Experimental results are presented which indicate that low fluxes of vacuum UV (VUV) radiation exert a pronounced influence on the atomic oxygen reactivity of such fluorocarbon and fluorocarbon spacecraft materials as the FEP Teflon and PCTFE that are under consideration for the Space Station Freedom. With simultaneous exposure to VUV fluxes comparable to those experienced in LEO, the reactivity of these materials becomes comparable to that of Kapton; VUV radiation has also been shown to increase the reactivity of Kapton with thermal-energy oxygen atoms. 8 refs.

44834 Interactions of water-soluble porphyrins and metalloporphyrins with smectite clay surfaces. Carrado, K.A. (Argonne National Lab., IL (USA)); Winans, R.E. *Chemistry of Materials (USA)*, 2(3): 328-335 (May-Jun 1990). DOE Contract W-31-109-ENG-38.

Two simple water-soluble meso-substituted porphyrins were ion-exchanged int the interlayer space of montmorillonite, hectorite, and fluorhectorite. The porphyrins studied were the chloride salts of tetrakis(1-methyl-4-pyridiniumyl)porphyrin (TMPyP) and tetrakis(N,N,N-trimethyl-4-aniliniumyl)porphyrin (TAP) and the corresponding metalloporphyrins Fe^{III}tap, Fe^{III}TMPyP, and Co^{II}TMPyP. These were ion-exchanged into H-, Li-, Na-, Ca-, Cu-, Co-, VO-, and Fe-montmorillonites and fluorhectorites. The porphyrins are diprotonated in H- and transition-metal-ion-exchanged clays.

44835 Optical absorption and emission of $GaP_{1-x}Sb_x$ alloys. Reihlen, E.H. (University of Utah, 304 EMRO, Salt Lake City, Utah 84112 (USA). Department of Electrical Engineering); Jou, M.J.; Jaw, D.H.; Stringfellow, G.B. *Journal of Applied Physics (USA)*, 68(2): 760-767 (15 Jul 1990). DOE Contract FG02-84ER45061.

The first detailed optical investigation of the metastable III/V semiconductor alloy $GaP_{1-x}Sb_x$ is presented. Epilayers are grown by atmospheric pressure organometallic vapor phase epitaxy throughout the entire compositional range on GaP, GaAs, and GaSb substrates. The approximately 1-μm-thick layers are partially strained with values of lattice mismatch as large as 1.7×10^{-2}. Values of band gap are determined for the first time from absorption spectra measured at 10 and 300 K and corrected for strain-induced energy shifts. The resultant values of bowing parameter for the direct and indirect band gaps are c_Γ=3.11±0.18 eV and c_x=2.06±0.18 eV, independent of temperature, yielding a value of direct/indirect crossover composition, x_c, of 0.32±0.07. Single photoluminescence (PL) peaks are observed between 10 and 300 K for all samples. For samples with $0.37\leq x\leq0.47$, they are assigned to recombination of carriers localized in bandtail states induced by compositional fluctuations. The stretch of the tails into the gap is greatly enhanced over the random alloy limit by the metastability of the $Ga_{1-x}Sb_x$ alloys. PL peaks for samples with $x\leq0.32$ are assigned to recombination via deep centers in the gap. The PL peak of a sample with x=0.91 is assigned to recombination involving shallow acceptors.

44836 The role of radiation in melt stability in zone-melt recrystallization of SOI. Knapp, J.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (USA)); Thompson, L.R.; Collins, G.J. *Journal of Materials Research (USA)*, 5(5): 998-1002 (May 1990). DOE Contract AC04-76DP00789.

Under circumstances in Zone-Melt-Recrystallization (ZMR) of Si-on-Insulator (SOI) structures where radiative heat loss is significant, the ~50% decrease in emissivity when Si melts destabilizes the Si molten zone. We have demonstrated this both experimentally using a slowly scanned e-beam line source and numerically with a finite-element computational simulation. The resulting instability narrows the process window and tightens requirements on beam control and background heating uniformity, both for e-beam ZMR systems and optically-coupled systems such as a graphite strip heater.

44837 Nondestructive investigation of damage in composites using x-ray tomographic microscopy (XTM). Kinney, J.H. (Chemistry and Materials Science Department, Lawrence Livermore National Laboratory, Livermore, California 94551 (USA)); Saroyan, R.A.; Johnson, Q.C.; Stock, S.R.; Breunig, T.M.; Nichols, M.C.; Bonse, U.; Nusshardt, R. *Journal of Materials Research (USA)*, 5(5): 1123-1129 (May 1990).

X-ray tomographic microscopy (XTM), utilizing intense, highly collimated synchrotron radiation, has been used to nondestructively image materials structures in three dimensions. The spatial resolution of the technique approaches that of conventional optical microscopy, but XTM does not require polished surfaces or serial sections. We present the results of an XTM investigation of a composite material composed of silicon-carbide fibers in an aluminum matrix. The results reveal the aluminum/silicon-carbide interfaces and show microcracks running along many of the interfaces as well as in the matrix. Excellent contrast is observed between the silicon-carbide sheath of the fiber surrounding the graphite core and the coating at the fiber-matrix interface. The sensitivity to small changes in the linear absorption coefficient allows nondestructive imaging of variations in chemistry between graphite and silicon carbide and between silicon carbide and aluminum. The experimentally determined values of the absorption coefficients of these phases are identical to values published in the literature. For the first time, XTM will allow observation of damage accumulation and crack growth *during* deformation testing. The availability of such data will greatly improve our understanding of failure in advanced materials.

44838 The first ambient pressure organic superconductor containing oxygen in the donor molecule, β_m-(BEDO-TTF)$_3$Cu$_2$(NCS)$_3$, T_c = 1.06 K. Beno, M.A. (Argonne National Lab., IL (USA)); Wang, H.H.; Kini, A.M.; Carlson, K.D.; Geiser, U.; Kwok, W.K.; Thompson, J.E.; Williams, J.M.; Ren, Jingquing; Whangbo, Myunghwan. *Inorganic Chemistry (USA)*, 29(9): 1599-1601 (2 May 1990). DOE Contract W-31-109-ENG-38 ;FG05-86ER45259.

The discovery of superconductivity in an organic charge-transfer salt containing an oxygen-bearing organic-donor molecule is reported. The synthesis of the compound, β_m-(BEDO-TTF)$_3$Cu$_2$(NCS)$_3$ BEDO-TTF = bis(ethylenedioxy) tetrafulvalene, is

described. Its crystal structure, its characteristic ESR properties, results of inductive measurements of its superconducting transition, and its band electronic structure are all reported. 18 refs., 3 figs.

44839 Polymeric anions leading to novel packing motifs in donor-radical salts: Synthesis and crystal and band electronic structure of (BEDT-TTF)BiI_4. Geiser, U. (Argonne National Lab., IL (USA)); Wang, H.H.; Budz, S.M.; Lowry, M.J.; Williams, J.M.; Ren, Jinqing; Whangbo, Myunghwan. *Inorganic Chemistry (USA)*, 29(9): 1611-1614 (2 May 1990). DOE Contract W-31-109-ENG-38 ;FG05-86ER45259.

In an attempt to synthesize a 2:1 salt of bis(ethylenedithio)tetrathiafulvalene (BEDT-TTF or ET, $C_{10}H_8S_8$) with soft C-H$\cdots$ anion contacts, which promote an increase in the superconducting transition temperature, T_c, in β-$(ET)_2X$ salts, the authors carried out slow electrocrystallization of ET with BiI_3 and $[(n\text{-}C_4H_9)_4N]I$ in 1,1,2-trichloroethane. This led to an unexpected 1:1 salt, $(ET)BiI_4$, which was characterized by X-ray single-crystal diffraction. The polymeric anion, a $[BiI_4^-]_\infty$ chain, contains $[BiI_6]$ octahedra sharing edges, such that the two terminal iodide ligands are in a cis configuration. ET^+ cations form a network of $(ET^+)_2$ dimers, connected by S$\cdots$S contacts shorter than the sum of the van der Waals radii (3.6 Å). The spin susceptibility as a function of temperature, derived from ESR measurements, follows Curie's law down to 20 K, but a spin count indicates that the ESR signal is due to an impurity (less than 1%). Band electronic structure calculations on the $(ET^+)_2$ layer predict $(ET)BiI_4$ to be a semiconductor with a band gap of order 0.4 eV. Crystal data for the complex are reported. 25 refs., 4 figs., 3 tabs.

44840 Surface-defect formation in graphite targets during magnetron sputtering. Chen, C.W. (Chemistry & Materials Science Department, Lawrence Livermore National Laboratory, Livermore, California 94550 (USA)); Makowiecki, D.M.; Alford, C.S.; McKernan, M.A.; Ramsey, P.B. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3157-3162 (Jul 1990). DOE Contract W-7405-ENG-48.

Magnetron sputtering of graphite targets is frequently marred by the formation of topographic defects. The defects are either soft with a furry appearance or hard with a stalagmite appearance. The soft defects are often found on top of the hard ones, implying a close connection in formation sequence between the two types of defects. The formation mechanism of the hard defects is related to the presence on the surface of low sputtering-yield impurities or other types of lattice imperfections, which suppress the erosion induced locally by sputtering, and to porosity-induced asperities. The emergence of the soft defects is ascribed to a growth phenomenon involving redeposition of carbon from debris and possibly generated in a chemical vapor deposition (CVD) process. The gradual coverage of the target surface by defects causes a steady decrease of the sputtering rate of carbon. Also, the breakup of the soft defects promotes nodular defects in the subsequent growth of the carbon film, thus severely degrading the film quality. Remedial measures are devised for limiting the onset of defect formation.

44841 Doubly resonant coherent anti-Stokes Raman spectroscopy of Ce^{3+} in $LuPO_4$. Piehler, D. (Department of Physics, University of California, Berkeley, California 94720 (USA)); Edelstein, N. *Physical Review, A (General Physics) (USA)*, 41(11): 6406-6414 (1 Jun 1990). DOE Contract AC03-76SF00098.

We have measured coherent anti-Stokes Raman spectra between crystal-field levels of the $^2F_{5/2}$ and $^2F_{7/2}$ manifolds of the Ce^{3+} ion diluted in $LuPO_4$ at ~10 K. The anti-Stokes signal is nearly resonant with the lowest crystal-field level of the $5d^1$ configuration of Ce^{3+} at 30 460 cm^{-1}. For a $LuPO_4$ crystal doped with 0.06 mol % Ce^{3+}, we found enhancements of the third-order susceptibility $|\chi^{(3)R}/\chi^{(3)NR}|$ as high as 11.6. This enhancement is over 20 times larger than that seen previously in singly resonant experiments with pure rare-earth crystals.

44842 Perforated monolayers: Design and synthesis of porous and cohesive monolayers from mercurated calix[n]arenes. Markowitz, M.A. (Lehigh Univ., Bethlehem, PA (USA)); Janout, V.; Regen, S.L.; Castner, D.G. *Journal of the American Chemical Society (USA)*, 111(21): 8192-8200 (11 Oct 1989).

Mercuration of a series of O-alkylated calix[n]arenes (produced via reaction of tetrahydroxycalix[4]arene, pentahydroxylcalix[5]arene, hexahydroxycalix[6]arene, and heptahydroxycalix[7]arene with n-bromobutane and with n-bromohexadecane) afford an homologous series of calixarene-based surfactants that form stable monolayers at the air-water interface. Surface pressure-area isotherms, measured for each calixarene, yield limiting areas that are in excellent agreement with values predicted from space-filling models, if it is assumed that the base of each calixarene is parallel and the alkyl chains are perpendicular to the water surface. Introduction of malonic acid to the aqueous subphase results in a substantial increase in the cohesiveness of films derived from calix[4]arene-, calix[5]arene-, and calix[6]arene-based surfactants, as judged by changes in surface viscosity. X-ray photoelectron spectroscopic analysis of a Langmuir-Blodgett film, produced from a malonic acid stabilized calix[6]arene monolayer, shows a carboxylate/mercury ratio of 0.9.

44843 Method for forming metallic silicide films on silicon substrates by ion beam deposition. Zuhr, R.A.; Holland, O.W. To Dept. of Energy, Washington, DC (USA). USA Patent 4,908,334/A/. 13 Mar 1990. Filed date 24 Jan 1989. USA Patent Application 7-300,863. Int. Cl. H01L 21/24. 8p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes metallic silicide films formed on silicon substrates by contacting the substrates with a low-energy ion beam of metal ions while moderately heating the substrate. The heating of the substrate provides for the diffusion of silicon atoms through the film as it is being formed to the surface of the film for interaction with the metal ions as they contact the diffused silicon. The metallic silicide films provided by the invention are contaminant free, of uniform stoichiometry, large grain size, and exhibit low resistivity values which are of particular usefulness for integrated circuit production.

40 CHEMISTRY

4001 Analytical and Separations Chemistry

Refer also to citation(s) 43696, 43698, 43701, 43907, 43911, 43914, 43916, 43938, 43941, 43944, 44018, 44285, 44693, 44762, 44880, 45064, 45187, 45188, 45192, 45266, 45524, 45559, 45560, 45563, 45564, 45566, 45567, 45570, 45572, 45590, 45691, 45737, 45739, 45740, 45929, 45930, 46071, 46072, 46133, 46173

44844 (BNL–43176) **Synchrotron radiation and its application to chemical speciation: A review.** Gordon, B.M.; Jones, K.W. Brookhaven National Lab., Upton, NY (USA). [1990]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891206–13: International chemical congress of Pacific Basin Societies (PACIFICHEM '89), Honolulu, HI (USA), 17-22 Dec 1989). Order Number DE90015094. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Synchrotron radiation can be used in Extended X-ray Absorption Fine Structure (EXAFS) and X-ray Absorption Near Edge Structure (XANES) experimental modes to extract information concerning chemical speciation of elements at trace concentration levels. The structure and relative position of an absorption spectrum at high energy resolution in the absorption edge region provide information regarding the oxidation state of the element and symmetry of the molecule in the immediate vicinity. Speciation is elucidated by comparison of spectra with those of model compounds. Examples of such studies in the literature are presented. The technique, which generally requires no chemical preparation, is sensitive in the mg/kg concentration range in biomedical tissue samples. The recent proliferation of intense and dedicated synchrotron radiation sources provides wide access to the technique. 26 refs., 10 figs.

44845 (CONF-9007139–1) **Positron ionization mass spectrometry: An organic mass spectrometrist's view.** Glish, G.L.; Donohue, D.L.; McLuckey, S.A.; Eckenrode, B.A.; Hulett, L.D. Jr. Oak Ridge National Lab., TN (USA). [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400.

From 3. international workshop on positron and positronium chemistry; Milwaukee, WI (USA); 16-19 Jul 1990. Order Number DE90015154. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We are currently engaged in a research program to study the ionization of polyatomic molecules by positrons. We refer to the technique herein as positron ionization mass spectrometry which includes all of the possible ionization mechanisms. In the course of this work we will attempt to characterize each of the important ionization mechanisms. Our ultimate objective is to explore the use of positron ionization mass spectrometry for chemical analysis. Several other groups have also begun to pursue aspects of positron ionization in parallel with our efforts although with somewhat different approaches and, perhaps with slightly different emphases. Recently, for example, Passner et al. have acquired mass spectra in a Penning trap resulting from the ionization of several different polyatomic molecules by near thermal kinetics energy positrons. Our research involves studying the different types of ionizing interactions of positrons with organic molecules, as a function of positron kinetic energy. For ionization of polyatomic molecules by positrons, several possible mechanisms are apparent from lifetime and scattering cross-section data. These mechanisms are discussed.

44846 (CSCHE–CE0389-Vol.1) **Proceedings of 2nd international conference on seperations science and technology: Vol. 1.** Baird, M.H.I. (McMaster Univ., Hamilton, ON (Canada)); Vijayan, S. (eds.). Canadian Society for Chemical Engineering, Ottawa, ON (Canada). 1989. 414p. (CONF-891070–: 2. international conference on separation science and technology, Hamilton (Canada), 1-4 Oct 1989; CE–03089). Source: Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, ON, CAN K1G 3Y6. Prices: PRICES UPON REQUEST.

An international conference was held concerning separations science and technology. Papers were presented on the topics of novel separation processes, food and beverage industry separations, metallurgical separations, nuclear separations, chemical and allied industry separations and environmental separations. A separate abstract has been provided for one paper.

44847 (CSCHE–CE03090-Vol.2) **Proceedings of 2nd international conference on separations science and technology: Vol. 2.** Baird, M.H.I. (McMaster Univ., Hamilton, ON (Canada)); Vijayan, S. (eds.). Canadian Society for Chemical Engineering, Ottawa, ON (Canada). 1989. 337p. (CONF-891070–: 2. international conference on separation science and technology, Hamilton (Canada), 1-4 Oct 1989; CE–03090). Source: Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, ON, CAN K1G 3Y6. Prices: PRICES UPON REQUEST.

An international conference was held, concerning separations science and technology. Papers were presented on the topics of membranes supercritical extractions, solvent extractions, sorptive processes, precipitation and crysallization and biochemical separations. A separate abstract has been provided for one paper.

44848 (DOE/ER/13552–5) **Analysis and computer tools for separation process involving nonideal mixtures: Progress report, December 1, 1989–November 30, 1990.** Lucia, A. Clarkson Univ., Potsdam, NY (USA). 13 Jul 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13552. Order Number DE90015404. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of this research is to exploit the synergy that exists between mathematical analysis, numerical analysis and algorithmic development/improvement in order to advance our theoretical and practical understanding of the preliminary design, simulation and control system design tasks associated with separation processes involving nonideal mixtures. This report briefly discusses progress in these areas over the past contract year.

44849 (DOE/ER/13833–7) **[Compensation for peak shifts and variable background responses in fluorescence spectroscopy]: Progress report, February 1, 1988–August 1, 1990.** Rutan, S.C. Virginia Commonwealth Univ., Richmond, VA (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13833. Order Number DE90015068. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A number of significant advances have been made on the research described in the original proposal, as well as in a new direction, where initial results are extremely promising. All of the projects undertaken have significantly increased the reliability of fluorescence detection methods for planar and column chromatographic methods. In the area of column chromatography, we have designed and constructed a computer controlled gradient liquid chromatograph, with diode array fluorescence detection. With instrument we can detect approximately 200 nm of the emission spectra of components eluting from chromatographic column. We can significantly improve the reliability of quantitative results obtained with the techniques discussed below. This report is divided into three sections describing the advances made in fluorescence background compensation, fluorescence response shift correction, and planar chromatographic-kinetic analyses. 1 fig.

44850 (ETDE-IT–90-04) **Foreign-gas pressure broadening and shift of ammonia transition lines in the nu_2 vibrational bands.** Baldacchini, G.; Bizzarri, A.; Nencini, L.; Sorge, V.; Buffa, G.; Tarrini, O. ENEA, Frascati (Italy). Centro Ricerche Energia; Pisa Univ. (Italy). Jun 1989. 24p. Order Number DE90514458. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Journal of Quantum Spectroscopy & Radiative Transfer.

Foreign gas broadening and shift have been measured for transition in the nu_2, $2nu_2$and nu_4 bands of ammonia using a diode laser spectrophotometer. The measurements were performed by using foreign gases such as carbon dioxide, nitrogen, air, hydrogen and helium at room temperature. The pressure broadening and shift coefficients can be useful in modelling planetary atmospheres and the recently developed infrared ammonia laser. The experimental results are compared with the Anderson-Tsao-Curnette theory for carbon dioxide and nitrogen foreign gases which have large quadrupole moments. The agreement is satisfactory on average.

44851 (ETDE-IT–90-16) **C.A.R.S. diagnostics on photochemical reactors: Detection of reaction intermediates in IR laser vapour deposition of ultrafine SIC powder.** Fantoni, R.; Bijnen, F.; Djuric, N.; Piccirillo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 2p. (CONF-9008137–1: 12. international conference on raman spectroscopy, Columbia (S is not a valid Country Code.), 13 Aug 1990). Order Number DE90514491. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 12th international conference on raman spectroscopy (Columbia, 13-17 Aug 1990).

Short communication CHEMICAL REACTORS/diagnostic techniques; POWDERS; SILICON CARBIDES; CARBON DIOXIDE LASERS; POWER RANGE 10-100 KW; PHOTOCHEMICAL REACTIONS; COHERENT SCATTERING; RAMAN SPECTRA

44852 (INS-T–491) **A quantitative measurement of the oxygen amount in Si target.** Sugai, Isao; Nonaka, Itaru. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1990. 32p. (In Japanese). Order Number DE90513785. Source: NTIS (US Sales Only), PC A03/MF A01.

Enriched self-supporting targets of ^{28}Si, ^{29}Si, ^{30}Si are often used in the field of high resolution nuclear physics experiments. The Si targets prepared by the thermal vacuum evaporation, however, are always contaminated by oxygen, as the Si is easily oxidized. These contaminated targets lead to poor data with low S/N ratio. Thus it is very useful if one can estimate the amount of oxygen in the target quantitatively before experiments. In this work we have developed the method to estimate the amount of oxygen in the Si target. It has α-ray and β-ray thickness gauges, which have different sensitivity to the oxygen atom. Namely, the α-ray gauge is more sensitive to the light element such as oxygen compared to the β-ray gauge. Thus one can deduce the amount of the oxygen by comparing the thickness measured by α-ray gauge with that of the β-ray gauge. The accuracy of a few percents can be obtained for the oxygen amount in the SiO_2 target with thickness of 1 mg/cm^2. The present method can be applied also to heavy elements such as Ta_2O_5. (author).

44853 (JAERI-M–90-015) **Present status for the determination of metallic impurities in nuclear fuels by atomic emission spectroscopy (review report).** Handa, Muneo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Shiozawa, Ken-ichi; Hirata, Masaru; Fukushima, Susumu. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. 142p. (In Japanese). Order Number DE90513763. Source: NTIS (US Sales Only), PC A07/MF A01.

Present status for the determination of metallic impurities in nuclear fuels by atomic emission spectroscopy (AES) is reviewed. In the first chapter of introduction, brief progress of the developments of AES is described. In the second chapter, emission spectrograph with direct current arc (DCA) or inductively coupled plasma (ICP) source is shown with the emphasis on the confinement of plutonium. In the third chapter, impurity elements and maximum concentration limits in various nuclear fuels and equivalent boron content factors are given on the base of ASTM (American Society for Testing and Materials) standards in 1987. In the fourth chapter, examples of the analyses of nuclear fuels by DCA-AES and carrier distillation method, and the results of standard uranium oxide analysis conducted by 15 AEC-connected laboratories in U.S.A. are presented. In the fifth chapter, the determination of rare earth elements by DCA-AES after the chemical separation of U and Pu by solvent extraction, ion-exchange and so on. In the sixth and seventh chapters, the determination of U and Pu, and metallic impurities in U and Pu fuels by ICP-AES are described, respectively. In the eighth chapter, the determination of Am by ICP-AES is explained. In the ninth chapter, a comparison of the detection limits in aqueous solutions for various spectrometric techniques including recently developed laser-induced atomic fluorescence spectroscopy (LIF) and laser-enhaned ionization spectroscopy (LEI) are given. In the last chapter, experimental plan using DCA-AES and ICP-AES installed this time at Plutonium Fuel Research Laboratory of Oarai Research Establishment is introduced. (author).

44854 (LA-UR–90-2204) **FRAM [Fixed Energy, Response Function Analysis with Multiple Efficiency]: A new, versatile gamma-ray spectrometry code for measuring the isotopic composition of plutonium.** Sampson, T.E.; Nelson, G.W.; Kelley, T.A. Los Alamos National Lab., NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9007106–51: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015106. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe the characteristics and features and demonstrate the performance of a new code (FRAM) for determining the isotopic composition of plutonium using gamma-ray spectroscopy. This versatile code can measure an extremely wide range of isotopic compositions and is extremely easy to tailor to specialized measurement conditions. Measurement precision, accuracy, and throughput are significantly improved over previous Los Alamos National Laboratory (LANL) codes. 13 refs., 2 figs., 4 tabs.

44855 (ORNL/FTR–3707) **[Research activities in actinide chemistry and small angle scattering research]: Foreign trip report, July 28, 1990–August 11, 1990.** Toth, L.M. Oak Ridge National Lab., TN (USA). 16 Aug 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015974. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this trip was twofold – first, to visit two laboratories (in France and Germany) and to discuss actinide research activities sponsored by DOE's Office of Basic Energy Sciences; and, second, to attend the VIII International Meeting on Small Angle Scattering (in Leuven, Belgium) where the traveler would present a paper on ORNL research. The visits to the two laboratories were motivated by a mutual interest in maintaining an environment where basic research of common interest could be freely discussed. We have exchanged visits with these laboratories in the past, and many of their staff members are well-known by ORNL personnel. With changing programs at the various laboratories, we have witnessed an increasing interest from these laboratories, especially from the French, in the research conducted within Chemical Technology Division. With the current trends in programs and regulations, it was anticipated that the sharing of results in actinide research would be beneficial. The International Small-Angle Scattering Meeting occurs approximately every 3 years, and representatives from all the leading centers in the world customarily attend. Our objectives were to advertise both the current results on zirconium hydrous polymers and the future requirements in this field and to establish contacts with leaders in small-angle scattering research. These objectives were very satisfactorily met.

44856 (PPCCF-T–89-01) **Study of the physical phenomena in the transformation of the in vivo implanted coral, using radioactivation techniques, by means of X-ray diffraction and infrared spectrometry.** Oudadesse, H. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1989. 139p. (In French). Order Number DE90514618. Source: NTIS (US Sales Only), PC A07/MF A01.

By radioactivation analysis, we measured quantitatively for the first time the elementary transformation of coral in vivo. Some natural coral was implanted after having been sterilized in ovine jaws. Every month, biopsies were extracted in order to get a portion of the external cortical part, the intermediary part (initially the coral) and the internal cortical part. We measured the kinetics of the concentration of major atomic elements which constitute the biological mould such as phosphorus, calcium, magnesium, fluorine, as well as strontium of which content was abundantly found in the coral. The results show intense disturbances until the fifth month, when the mineral structure of the implanted coral becomes akin to that of bone come to maturity. In addition, with measures by diffraction by X-ray, we have followed the structural modifications by relating them to the variation in concentration of atomic elements. The coral, in the form of aragonit and stabilized by strontium as shown by neutron radioactivation crystallises in an orthorombic system. Three months after having been implanted, its structure becomes hexagonal and reaches a degree of crystallization similar to that of a bone come to maturity about the fifth month. The infrared absorption spectroscopy allowed us to fine the structure by specifying the mineral of the bone and of the implanted coral. Three months after having been implanted, the coral has become an apatite with deposit of organic substances. Moreover, a calcination at high temperature revealed a supply of phosphorus ions from the first month until the fifth month.

44857 (SAND–90-1084C) **Phosphorus determination in borophosphosilicate or phosphosilicate glass films on a Si wafer by wavelength dispersive x-ray spectroscopy.** Levine, H.S.; Higgins, K.L. Sandia National Labs., Albuquerque, NM (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9007149–2: 39. annual Denver x-ray conference, Steamboat Springs, CO (USA), 30 Jul - 3 aug 1990). Order Number DE90015830. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this report, peak shift effects in the SiO_2/Si(100) system due to chemical bonding are demonstrated. The detailed development of the equations appears in a paper submitted for publication in the Journal of X-ray Spectroscopy. These equations are for the spectral line intensity of Si and P from BPSG films and from the Si in the Si(100) substrate. They are subsequently integrated into two simultaneous equations that can be solved for the phosphorus content and the surface density by a computer program using iterative methods. The general expressions for the BPSG films and the computer program are also applicable to PSG films by setting the boron content to zero. The new procedure was then tested by analysis of a well-defined and carefully prepared set of PSG wafer samples. Preliminary analyses were also made on BPSG wafers. 3 refs., 4 figs., 3 tabs.

44858 (UM-P–89/90) **Computer-simulated images of icosahedral, pentagonal and decagonal clusters of atoms.** Peng JuLin; Bursill, L.A. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 29p. Order Number DE90637383. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The aim of this work was to assess, by computer-simulation the sensitivity of high-resolution electron microscopy (HREM) images for a set of icosahedral and decagonal clusters, containing 50-400 atoms. An experimental study of both crystalline and quasy-crystalline alloys of A1(Si)Mn is presented, in which carefully-chosen electron optical conditions were established by

computer simulation then used to obtain high quality images. It was concluded that while there is a very significant degree of model sensitiveness available, direct inversion from image to structure is not at realistic possibility. A reasonable procedure would be to record experimental images of known complex icosahedral alloys, in a crystalline phase, then use the computer-simulations to identify fingerprint imaging conditions whereby certain structural elements could be identified in images of quasi-crystalline or amorphous specimens. 27 refs., 12 figs., 1 tab.

44859 Laser spectroscopy and its applications. Optical engineering. Volume 11. Radziemski, L.J. (New Mexico State Univ., Las Cruces, NM (USA). Dept. of Physics); Solarz, R.W.; Paisner, J.A. 685p. Marcel Dekker Inc., New York, NY (USA) (1987).

This book discusses the tools and concepts used by practitioners in the field of laser spectroscopy and provides reference material for further study. Resonance photoionization, laser absorption, laser-induced breakdown, photodissociation, Raman scattering, remote sensing, and laser-induced fluorescence are presented.

44860 Extraction studies of M(TTA)$_n$ + crown ether complexes. Choppin, G.R. (Florida State Univ., Tallahassee (USA)); Mathur, J.N. pp. 13, Paper I & EC 36 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Calorimetric titration, solvent extraction, fluorimetry, and NMR spectrometry have been used to study the systems Metal + TTA + Crown Ether. The metals were Nd^{3+}, Eu^{3+}, Th^{4+}, and UO_2^{2+}. M(TTA)$_n$ + CE systems exhibit synergistic extraction and this study sought to understand the nature of the metal-CE interaction, the residual metal hydration, the stoichiometry of the extraction, the relationship between the magnitude of the synergistic effect and the cavity size of the C.E.

44861 Soft donor ligands for actinide/lanthanide separations. Smith, B.F. (Los Alamos National Lab., NM (USA)); Jarvinen, G.D. pp. 13, Paper I & EC 37 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The authors have been exploring mixed multidentate ligands (e.g. thiopyrazolones, etc) for their ability to separate actinide (An) from lanthanide (Ln) ions, and An from other An ions. When one of the donor atoms is soft (e.g. S), the authors are able to realize separation factors greater than 100 between Am(III) and Eu(III), historically one of the most difficult separations to achieve. Separation factors in a similar range between all Ln(III) ions and several An(III) are likewise observed. A variety of soft donor systems will be discussed along with their chemical and separation characteristics.

44862 Laser Raman techniques. Valentini, J.J. (California Univ., Irvine, CA (USA)). pp. 507-564 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper discusses laser induced Fluorescence and Raman spectroscopy. Lasers are used for study of atoms, molecules and various chemicals. Principles and theory as well as applications of monochromatic radiation scattering are discussed.

44863 Metal-to-ligand charge-transfer (MLCT) photochemistry. Experimental evidence for the participation of a higher lying MLCT state in polypyridyl complexes of ruthenium(II) and osmium(II). Lumpkin, R.S. (Univ. of North Carolina, Chapel Hill (USA)); Worl, L.A.; Murtaza, Z.; Meyer, T.J.; Kober, E.M. *Journal of Physical Chemistry (USA),* 94(1): 239-243 (11 Jan 1990).

Evidence is presented which supports the existence of a thermally accessible, higher lying metal-to-ligand charge-transfer (MLCT) excited state for polypyridyl complexes of Ru(II) and Os(II). This state is shown to exist for complexes both in solution and in the solid state. It is typically found to occur at 300-800 cm^{-1} above the lowest lying MLCT state and to have a decay rate constant of 10^6-10^9 s^{-1}. This decay rate constant is about 10 times faster than the decay rate constant for the next lower lying MLCT state. The decay process appears to be almost completely nonradiative with the radiative decay rate constant estimated to be 10^6 s^{-1} or slower. The higher lying MLCT states can make a significant contribution to nonradiative decay at room temperature.

44864 Laser-induced-fluorescence detection of SO and SO_2 in SF_6/O_2 plasma-etching discharges. Greenberg, K.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (USA)); Hargis, P.J. Jr. *Journal of Applied Physics (USA),* 68(2): 505-511 (15 Jul 1990). DOE Contract AC04-76DP00789.

Laser-induced-fluorescence spectroscopy was used to detect SO and SO_2 molecules in the active volume of 13.56-MHz discharges through mixtures of sulfur hexafluoride and oxygen. A KrF laser was used to excite the SO $B^3\Sigma$ state and the SO_2 $\tilde{B}^1B_1$ and $\tilde{C}^1B_2$ states. 235-nm light was used to directly monitor the ground-state densities of these molecules. For a 100-W discharge through a 12.5% oxygen mixture (42 sccm SF_6, 6 sccm O_2, 340-mTorr total pressure), the SO and SO_2 densities were determined to be $\sim 2\times10^{14}/cm^3$ and $\sim 4\times10^{13}/cm^3$, respectively. For the same discharge conditions, the SO vibrational temperature was ~880 K. The SO vibrational temperature was independent of oxygen content in our experiments.

44865 Soft x-ray lasers and their applications. Suckewer, S. (Princeton Univ., NJ (USA)); Skinner, C.H. *Science (Washington, D.C.) (USA),* 247(4950): 1553-1557 (30 Mar 1990).

The emerging technology of soft x-ray lasers has novel applications to microscopy, lithography, and other fields. This article describes the status of soft x-ray laser research with the aim of bringing the rapid developments in this field to the attention of potential users in other disciplines. The different techniques for generating a population inversion and producing a soft x-ray laser are reviewed. The status of current research in the field and the near-term prospects are described. It is expected that the range of potential applications of soft x-ray lasers will increase as their performance improves. Work aimed at increasing the output power and progressing to shorter wavelengths with these devices is also reviewed. 45 refs., 6 figs.

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Refer also to citation(s) 43798, 43807, 43942, 44081, 44224, 44772, 44778, 44780, 44781, 44782, 44783, 44784, 44785, 44810, 44824, 44842, 45066, 45067, 45265, 45326, 45606, 46068, 46129, 46131

44866 (CONF-900466–79) **On the effects of magnetic bonding in rare earth transition metal intermetallics.** Kumar, R. (Oak Ridge National Lab., TN (USA)); Bentley, J.; Yelon, W.B. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990. Order Number DE90015800. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Neutron diffraction experiments on rare-earth transition metal magnetic alloys $Er_2Fe_{14}B$ and Er_2Fe_{17} have been carried out at temperature above and below the ordering temperature (T_c). An anomalously large magnetic moment is observed at the crystallographic j_2 site in $Er_2Fe_{14}B$ which is the intersection point of the major ligand lines in the crystal structure. The interatomic Fe-Fe distances are in the range of strong ferromagnetic bonds ($\geq$ 2.66 Å). The analogous f site in Er_2Fe_{17} does not develop as large a magnetic moment. In addition, the same sites show strong preference for Fe atoms in the respective substituted compounds. Due to poor phase stability of Er_2 $(Co_xFe_{1-x})_{14}B$ compounds, iron substitution has been studied in detail in $Er_2(Co_xFe_{1-x})_{17}$ alloys for site specific order an lattice distortion effects. However, a nonlinear change in the c lattice parameter observed in the neutron diffraction results cannot be explained on the basis of site preference alone. The neutron refinement results indicate iron rich compositions in $Er_2(Co_xFe_{1-x})_{17}$ materials, which is related to random substitution of Fe dumbbell pairs in the rare earth sites in the lattice. However, extensive electron microscopy (selected area electron diffraction and high resolution imaging) of Er_2Fe_{17} and

$Er_2(Co_{.40}Fe_{.60})_{17}$ failed to reveal any microscopic inhomogeneity. 12 refs., 5 figs., 2 tabs.

44867 (CONF-9010168–1) **Stability of gaseous by-products in relation to sampling of SF_6 equipment.** James, D.R.; Sauers, I.; Harman, G.; Griffin, G.D.; Ryan, M. Oak Ridge National Lab., TN (USA). [1990]. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IERE workshop on GIS program; Toronto (Canada); 1-3 Oct 1990. Order Number DE90015152. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In analyzing gas samples taken from SF_6-insulated equipment it is generally assumed that the species in question remain stable throughout the sampling process and that the analyses accurately reflect the actual situation in the apparatus being tested. Frequently samples are shipped for analysis which may take from a few days to a few weeks of transit and storage time before testing is performed. Hence the sample must either remain stable over this time frame or at least change in a manner which is well understood in order to have reliable, accurate results. The same is also true for reference standards against which unknown samples are compared or calibrated. Failure to account for stability could lead to false conclusions which, for cases involving highly or moderately toxic compounds, could possibly result in higher exposure levels than expected. Many of the by-products of SF_6 are known to hydrolyze in the gas phase, such as SF_4 (sulfur tetrafluoride), SOF_2 (thionyl fluoride), and SOF_4 (thionyl tetrafluoride). Recently new processes involving decomposition on surfaces have been identified, making such parameters as surface to volume ratio, wall material, and adsorbed moisture, important to the overall sampling and analytical process. This paper discusses the stability by-products in relation to the sampling of SF_6 equipment. 4 refs., 2 figs.

44868 (DOE/ER/13564–8) **Controlled synthesis of polyenes by catalytic methods: Progress report, August 1, 1989–July 31, 1990.** Schrock, R.R. Massachusetts Inst. of Tech., Cambridge, MA (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13564. Order Number DE90015654. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Controlled synthesis of polyenes is discussed in this progress report. Several lines of research is being pursued and are briefly discussed. (FI)

44869 (DOE/ER/13569–5) **Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1989–November 30, 1990.** Jones, W.D. Rochester Univ., NY (USA). Jul 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13569. Order Number DE90015826. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project is directed toward the continued investigation of the fundamental thermodynamic and kinetic factors that influence carbon-hydrogen bond activation at homogeneous transition metal centers. The project is also directed toward the conversion of hydrocarbons into functionalized products of potential use to chemical industry. In the past year, advances have been made in both understanding the interactions of hydrocarbons with metals and in the functionalized of hydrocarbons. Major advanced that have been made include: (1) We have found that $RhCl(PR_3)_2(CNR)$ complexes can catalyze the insertion of isonitriles into the C-H bonds of arenes upon photolysis. (2) We have also examined reactions of a series of arenes with $(C_5Me_5)Rh(PMe_3)PhH$ and begun to map out the kinetic and thermodynamic preferences for arene coordination. (3) We have begun to examine the reactions of rhodium pyrazolylborates for isonitrile functionalization of C-H bonds. (4) We have completed studies of the reactions of $(C_5Me_5)Rh(PMe_3)H_2$ with D_2 and PMe_3 that indicate that both $\eta^5 \rightarrow \eta^3$ ring slippage and metal to ring hydride migration occur more faciley than reductive elimination of H_{12}. (5) We have examined the reactions of heterocycles with $(C_5Me_5)Rh(PMe_3)PhH$ and found that pyrrole and furan undergo C-H or N-H activation.

44870 (DOE/ER/13617–4) **Selective transformation of carbonyl ligands to organic molecules: Progress report, September 1, 1989–November 14, 1990.** Cutler, A.R. Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry. 16 Jul 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13617. Order Number DE90015387. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Three objectives of our studies on the catalytic hydrosilation of organo-transition metal acyl complexes have been attained. First, efficient catalysts and near optimal reaction conditions now supersede our previous procedures using $(PPh_3)_3RhCl$. Manganese acyl compounds $L(CO)_4MnCOR$ [L = CO/R = Me, Ph; L = PPh_3, PEt_3/R = Me] as catalysts (0.1 to 10%) promote addition of R'_2SiH_2 (R' = Et, Ph) and R'_3SiH (R'_3 = Et_3, Me_2Ph) across $FpCOR''$ (R'' = Me, Ph), our test substrates. Second, diastereo-selective hydrosilylation [$(PPh_3)_3RhCl$ catalysis/R'_2SiH_2] of chiral Fe and Ru acetyl complexes $Cp(L)(CO)M\text{-}COCH_3$ (L = $P(OMe)_3$, PEt_3, PPh_3) has been achieved. Studies in progress focus on comparing this diastereoselectivity with that observed in generating corresponding α-alkoxyethyl complexes from reduction of Cp(L)(CO)M = $C(OEt)CH_3^+$ and on minimizing the subsequent conversion of the resulting siloxyethyl complexes to their vinyl derivatives, Cp(L)(CO)M – CH = CH_2. Third, coupling hydrosilylation and subsequent carbonylation steps has been achieved using $(CO)_5Mn$ acyl complexes. Satisfactory progress also is being made on the hydrosilylation (catalytic-potentially drastereoselective) then carbonylation of (η^5-indenyl)Ru acetyl compounds, In(L)(CO)Ru–$COCH_3$.

44871 (DOE/ER/45298–6) **Synthesis and properties of novel cluster phases: Progress report.** DiSalvo, F. Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry. 26 Feb 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45298. Order Number DE90015824. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report contains summary of our accomplishments under this grant. All the research so supported falls in the area of cluster compounds, those solid state compounds that contain metal clusters. Major goals of the research were to examine the solution chemistry of clusters and the compounds that could be prepared from these solutions, to synthesize new cluster phases, and to examine the properties of the materials so produced. As illustrated below we have succeeded in this endeavor and have shown that many new opportunities remain for future work. That future work is the subject of a renewal proposal.

44872 (DOE/ER/60514–4) **Intermolecular potential functions from spectroscopic properties of weakly bound complexes: First progress report, July 1, 1989–June 30, 1990.** Muenter, J.S. Rochester Univ., NY (USA). Dept. of Chemistry. 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60514. Order Number DE90015862. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of the proposed work is to study weakly bound molecular complexes to better understand intermolecular interactions. Intermolecular potential functions play major roles in every aspect of chemistry, including both atmospheric and biological systems. Techniques involving infrared laser and microwave excitation and absorption of molecular beams will be developed. Theoretical models to analyze experimental data in terms of potential functions will be created.

44873 (FRNC-TH–3598) **Semi-empirical equation of state obtained from a perturbation theory for the representation of hydrocarbon thermodynamical properties.** Dzialoszynski, L. Ecole Nationale Superieure des Mines, 75 - Paris (France). 1983. 115p. (In French). Order Number DE90514535. Source: NTIS (US Sales Only), PC A06/MF A01.

The aim of this work is to develop an equation of state for liquid and vapor in a large pressure and temperature range, representing accurately volumetric properties and properties along the saturation curve. The equation is tested with alkanes. An equation of state was proposed for elementary bodies by Ponce and Renon using a square well type intermolecular potential which is correct for simple molecules. Here this potential is considered as a pseudo-potential with temperature dependent adjustable parameters. For a higher accuracy a corrective term is added to Ponce and Renon equation.

44874 (GSF-BPT–2/89, pp. 30-37) **Spectroscopic investigations with HOCl.** Permien, T. (Kiel Univ. (Germany, F.R.). Inst. fuer Physikalische Chemie); Schindler, R.N. Gesellschaft fuer

Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere*. Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The role that HOCl plays in our atmosphere can only be ascertained, if due consideration is given to the atmospheric processes, by which this compound is degraded. Direct photochemical lysis by sunlight and degradation through radicals are among the theories put forward here. Repeat investigations of the absorption spectrum of HOCl for visible and short UV rays were rendered advisable by the fact that this chlorine compound or the products resulting from its photolysis are believed to range among the major factors discussed in connection with the antarctic ozone depletion to be observed each year in the spring. The spectra of all the chloride oxides investigated here showed a maximum in the 240 nm range, where absorption was very effective. Absorption was further seen with waves of greater length, even though this was less effective and varied between compounds. The two transition points differed in their reactivity to solvents and temperatures. (orig./KW).

44875 (LBL–28965) **Scanning tunneling microscopy studies of chemisorbed layers on metal surfaces.** Zeglinski, D.M. (California Univ., Berkeley, CA (USA). Dept. of Chemistry). Lawrence Berkeley Lab., CA (USA). Apr 1990. 125p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90015623. Source: NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Scanning Tunneling Microscopy (STM) is introduced as a technique for surface studies by outlining the tunneling process, the instrument capabilities, and the experimental requirements. STM theory is summarized, beginning with a simple description of quantum tunneling. Metal-vacuum-metal junction theory is presented using Bardeen's transfer Hamiltonian formalism. Most STM imaging theory is based on this construct. A review of the theoretical work pertaining directly to STM concludes the summary. STM studies of adsorbates are introduced with a brief description of surface chemical bond classifications, adsorbate interactions and adsorbate concentration effects. Following this is a review of previous STM work done on metal surfaces in Ultra-High Vacuum (UHV). Since the structure of the metal surface itself influences adsorbate geometry, both clean and adsorbate covered surfaces are discussed. The design and operation of a new STM is described. A review of other designs is presented for comparison. The microscope fits standard UHV systems as an add-on instrument. The techniques, Auger Electron Spectroscopy (AES), and Low Energy Electron Diffraction (LEED) are described since these surface sensitive methods are used to characterize the adsorbate systems studied. The surface structure of a graphitic carbon overlayer on a Pt(111) single crystal has been imaged with atomic resolution. The real space surface structure of the sulfur chemisorption series on Re(0001) surfaces has been imaged. While the saturation coverage structure ($(2\sqrt{3} \times 2\sqrt{3})R30°$) passivates the surface and can be imaged in air, the sub-saturation coverage structures can only be studied in UHV.

44876 (NIPER–422) **Determination of ideal-gas enthalpies of formation for key compounds: The 1988 project results.** Steele, W.V.; Chirico, R.D.; Nguyen, A.; Hossenlopp, I.A.; Smith, N.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jul 1990. 46p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90000247. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The results of a study aimed at improvement of group contribution methodology for estimation of thermodynamic properties of organic substances are reported. Specific weakness where particular group-contribution terms were unknown, or estimated because of lack of experimental data, are addressed by experimental studies of enthalpies of combustion in the condensed phase and vapor-pressure measurements. Ideal-gas enthalpies of formation are reported for 3-methylbuta-1,2-diene; 2,5-dimethylhexa-2,4-diene; acetaldoxime; N,N-diethylhydroxylamine; 1-methylpyrrolidin-2-one; and phenanthrene. Solid and liquid-phase enthalpies of formation at 298.15 K are determined for benzamide. Ring corrections, group terms, and next-nearest-neighbor interaction terms useful in the application of group contribution correlations are derived. 54 refs., 2 figs., 21 tabs.

44877 (PSI–62) **A thermodynamic description of the evolution of pore water chemistry and uranium speciation during the degradation of cement.** Berner, U. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland). Jun 1990. 76p. Order Number DE90636475. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

Portland cement, used as solidification-, backfill- and construction-material, is considered to determine the chemical behaviour of a low- and intermediate level radioactive waste repository for very long periods of time. In order to describe the long term chemical behaviour of such cement based structures, a series of submodels including the hydration of cement, the thermodynamic properties of calcium-silicate-hydrates and the degradation of hydrated cements in natural groundwaters have been developed. As an application, the leaching of uranium from a cement based structure is modelled. Cement hydration is modelled using Bogue's method. The incongruent solubility behaviour of calcium-silicate-hydrates (CSH-gels) is described using an approach directly applicable to common geochemical speciation codes. Within a mixing tank model, the results of the hydration and of the solubility model are used to describe the degradation of cement in natural groundwaters. As a representative for actinides, the solubility behaviour of uranium in degrading cement is modelled assuming an Eh of -300 mV. The uranium concentration in the pore solution is determined by the 'choice' of the solubility limiting phase. If the speciation is calculated by using the thermodynamic solubilities of the pure solids, concentration levels of about 10^{-4} M are found for U_3O_8, $USiO_4$, UO_2, U_4O_9 and 10^{-14} M for $CaUO_4$. Cumulative uranium leaching from hydrated cement is found to be nearly independent of cement and groundwater composition, but strongly dependent on the properties of the solubility limiting phase. An amount of 0.1 nmoles U/kg hydrated cement is completely leached out after 5 to 10 cycles using U_3O_8 as the solubility limiting solid, after ≈100 cycles using UO_2 and after ≈5000 (to 1000) cycles using $CaUO_4$. (author) 23 figs., 15 tabs., 43 refs.

44878 (SAND–90-0091C) **Thermochemical data for silicon-containing species from ab initio electronic structure calculations.** Ho, P. (Sandia National Labs., Albuquerque, NM (USA)); Melius, C.F. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901088–1: 11. international conference on chemical vapor deposition, Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90011024. Source: NTIS, PC A02/MF A01 - OSTI.

A combination of high-level ab initio electronic-structure calculations and empirical bond-additivity corrections are used to calculate thermochemical properties of gas-phase molecules. A self-consistent set of heats of formation for molecules in the SiH, Si–H–Cl, Si–H–F, Si–N–H and Si–N–H–F systems is presented.

44879 The influence of diluents on bifunctional extractants of the carbamoyl-phosphoryl class. Horwitz, E.P. (Argonne National Lab., IL (USA)); Diamond, H.; Chiarizia, R.; Martin, K.A. pp. 19, Paper I & EC 55 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). DOE Contract W-31-109-ENG-38. (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Changes in the diluent can have profound effects on the behavior of metal ion extractants. In no class of extractants is the diluent effect more vividly shown than in the class of neutral bifunctional carbamoyl-phosphoryl extractants. Examples of all of the above effects will be discussed. The interaction action or compatibility of an extractant with a variety of diluents can be determined by measuring the distribution ratio of the extractant. The interaction between an extractant and diluents can then be used to explain, to some extent, variations of metal extraction with different diluents.

44880 Characterization of siloxane polymer solvents by family regression of gas chromatographic retentions of aliphatic and aromatic prob-solutes. Laub, R.J. (Dept. of Chemistry, San Diego State Univ., San Diego, CA (US)); Tyagi, O.S. pp.

264-273 of Inverse gas chromatography: Characterization of polymers and other materials. Lloyd, D.R.; Ward, T.C.; Schreiber, H.P. American Chemical Society, Washington, DC (USA) (1989). (CONF-880604--: Joint meeting of the 195th national meeting of the American Chemical Society and the 3rd Chemical Congress of North America, Toronto (Canada), 5-11 Jun 1988).

This paper reports the family-plot retention data of 5 solutes with a series of poly (methylphenylsiloxane) stationary phases examined in terms of the saturation vapor pressure p_A of the solute, the methyl/phenyl ratio of the solvent and the temperature. Plots of ln V_g against ln p_A for a given solute over a range of temperature were found to be linear, as were the isothermals, that is, the retention/vapor-pressure plots for an homologous series of solutes at a constant temperature. The family-plot slopes exhibited by the n-alkane probe-solutes were also found to be very sensitive to the aromatic content of the polymers. Thus, it appears that the family technique of GC data reduction can be a useful tool for characterizing the physiochemical properties of (polymer) stationary phases.

44881 Laser-induced molecular dissociation: Applications in isotope separation and related processes. Lyman, J.L. (Los Alamos National Lab., NM (USA)). pp. 417-505 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987). DOE Contract W-7405-ENG-36.

This paper reviews the research and development of possible applications of laser photochemistry. Focus is on applications of laser-induced chemical reactions of molecular species. Purification and synthesis applications are also addressed.

44882 Investigations of adsorbed organic molecules in Na-Y zeolite by xenon-129 NMR. de Menorval, L.C. (Lawrence Berkeley Lab., CA (USA)); Raftery, D.; Liu, S.B.; Takegoshi, K.; Ryoo, R.; Pines, A. *Journal of Physical Chemistry (USA),* 94(1): 27-31 (11 Jan 1990). DOE Contract AC03-76SF00098.

The adsorption of n-hexane, benzene, and trimethylbenzene in Na-Y zeolite supercages has been investigated by use of xenon-129 NMR. As shown by Fraissard and co-workers, xenon-129 is an excellent probe of its environment in zeolites and is sensitive to the number of adsorbed guest molecules. The xenon-129 chemical shift, when extrapolated to zero effective xenon pressure, is 89.7 $\pm$ 0.1 ppm for benzene, 89.0 $\pm$ 1.3 ppm for trimethylbenzene, and 107.7 $\pm$ 1.2 ppm for n-hexane at a concentration of two guest molecules per zeolite supercage compared to 58.9 $\pm$ 0.5 ppm for empty Na-Y zeolite supercages. This approach is useful for determining the number of adsorbed molecules inside zeolite supercages and given information about their arrangement within the supercages.

44883 Charge distributions and effective atomic charges in transition-metal complexes using generalized atomic polar tensors and topological analysis. Cioslowski, J. (Los Alamos National Laboratory, NM (USA)); Hay, P.J.; Ritchie, J.P. *Journal of Physical Chemistry (USA),* 94(1): 148-151 (11 Jan 1990).

Advantages and shortcomings of three different definitions of the atomic charges, namely, the Mulliken, the generalized atomic polar tensors (GAPT), and the topological ones, are judged by applying them to the results of ab initio calculations on the TiF_4, $Ni(CO)_4$, and FeH_6^{4-} molecules. In agreement with previous reports, we find that the Mulliken charges vary widely with the choice of basis sets and therefore their utilization for the analysis of electronic structure of the transition-metal complexes is of little practical importance. On the other hand, both the GAPT and Bader's charges show a remarkable insensitivity to the quality of the basis sets.

44884 Decomposition of trimethylgallium on the gallium-rich GaAs (100) surface: Implications for atomic layer epitaxy. Creighton, J.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (USA)); Lykke, K.R.; Shamamian, V.A.; Kay, B.D. *Applied Physics Letters (USA),* 57(3): 279-281 (16 Jul 1990). DOE Contract AC04-76DP00789.

The decomposition of trimethylgallium (TMGa) on the gallium-rich (4×6) and (1×6) GaAs (100) surface was studied with temperature programmed desorption, Auger electron spectroscopy, and low-energy electron diffraction. TMGa was found to dissociatively chemisorb on the gallium-rich surfaces, apparently at the gallium vacancies that exist on these surfaces. We have unambiguously identified methyl radicals desorbing from the surface with the maximum rate at ~440 °C following a saturation TMGa exposure. Since TMGa was shown to decompose on the clean, gallium-rich GaAs (100) surfaces, the self-limiting deposition of gallium during atomic layer epitaxy must be due to the presence of surface methyl groups which inhibit further TMGa dissociative chemisorption.

44885 Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO. 1. Barrier height and dissociation rate constant. Chen, Ichia (Lawrence Berkeley Lab., CA (USA)); Moore, C.B. *Journal of Physical Chemistry (USA),* 94(1): 263-269 (11 Jan 1990). DOE Contract AC03-76SF00098.

Ketene cooled in a supersonic free jet is photolyzed in the ultraviolet range. The appearance rate of fragment CO from triplet ketene as a function of ultraviolet photon energy is measured by vacuum-ultraviolet laser-induced fluorescence. A tunneling-corrected RRKM theory is used to fit the observed dissociation rate of ketene using the ab initio vibrational frequencies of the transition state. The density of states inferred from the RRKM fit is a factor of 2 greater than the density of states of the ground electronic state (S_0) and 300 times greater than that of T_1. Tunneling corrections are necessary to fit the dissociation rate below the top of the exit barrier. The experimental rates show a sharp change in slope at 28,290-cm^{-1} photolysis frequency. The height of the exit barrier is determined to be 3.79 $\pm$ 0.06 kcal/mol above ground-state fragments. The imaginary frequency that fits the data is (150 $\pm$ 25)i cm^{-1}, much lower than the ab initio frequency of 523i cm^{-1}. At higher energies the RRKM theory predicts faster rates than are observed. It is possible that the intersystem crossing rate is relatively independent of energy and becomes the rate-determining step for formation of triplet products at higher energies.

44886 Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO. 2. Rotational-state distributions of product CO. Chen, Ichia (Lawrence Berkeley Lab., CA (USA)); Moore, C.B. *Journal of Physical Chemistry (USA),* 94(1): 269-274 (11 Jan 1990). DOE Contract AC03-76SF00098.

Ketene cooled in a supersonic jet is photolyzed at 1,120, 190, and 30 cm^{-1} above and at 50 cm^{-1} below the top of the barrier to dissociation on the triplet surface. The barrier is 1,330 cm^{-1} above $CH_2(\tilde{X}^3B_1)$ + CO. The rotational-state distributions of CO produced from triplet ketene are measured by vacuum-UV laser-induced fluorescence. These distributions cannot be described adequately by a Boltzmann temperature or by phase space statistical models. An average of 22.4 $\pm$ 1% of the total available energy goes to CO rotation as predicted by an impulsive model using the ab initio transition-state geometry. This indicates that the energy partitioning is determined by the geometry of the transition state with the repulsive force directed along the breaking bond. The fraction of energy going to CO rotation does not depend on the photolysis wavelength. The Gaussian shape of the CO rotational-state distribution can be understood quantitatively in terms of the zero-point motion of the C-C-O bending vibration of the transition state. Even when the excess energy above the top of the barrier is comparable to the barrier height itself, the energy release appears to be completely dynamically controlled.

44887 Resonance Raman evidence for electron and hole defect asymmetry in the quasi-one-dimensional mixed-valence solid $[Pt^{II}(en)_2][Pt^{IV}(en)_2Cl_2][ClO_4]_4$ (en = ethylenediamine). Donohoe, R.J. (Los Alamos National Lab., NM (USA)); Tait, C.D.; Swanson, B.I. *Chemistry of Materials (USA),* 2(3): 315-319 (May-Jun 1990).

Resonance Raman (RR) spectroscopy of $[Pt^{II}(en)_2][Pt^{IV}(en)_2Cl_2][ClO_4]_4$ provides both electronic and vibrational information about intrinsic local gap defect states. Selective enhancement of weaker RR features when tuning through the A and B band defect absorptions below the charge-transfer band edge serves to resolve the two absorption maxima into five distinct electronic transitions. The observed defect vibrational frequencies include a peak at 263 cm^{-1}, which is enhanced in two of the ranges, and a peak at 287 cm^{-1}, enhanced in two other ranges. Together with predictions from theoretical calculations and a previous study of photoinduced defects, the results herein allow

assignment of the two electronic transitions associated with enhancement of the 263-cm^{-1} band to electron polaron defect gap-to-gap and gap-to-band transitions and the two associated with 287-cm^{-1} band to corresponding transitions due to hole polaron defects.

44888 Phase behavior of inverse microemulsions for the polymerization of acrylamide in near-critical and supercritical continuous phases. Beckman, E.J. (Pacific Northwest Laboratories, Richland, WA (USA)); Smith, R.D. *Journal of Physical Chemistry (USA)*, 94(1): 345-350 (11 Jan 1990).

The inverse microemulsion polymerization of water-soluble acrylamide monomers within near-critical and supercritical alkane continuous phases provides a potential route for production of polymers with novel physical properties and at high reaction rates. In order to define conditions for a model polymerization process, the phase behavior of a nonionic surfactant/acrylamide/water system in near-critical and supercritical mixtures of ethane and propane was examined. Acrylamide was found to act as a cosurfactant due to its short chain length and hydrophilic character and this is probably coordinated about the surfactant's ethylene oxide units at the interface, rather than residing in the micelle core. The effects of temperature and composition on the phase behavior can be qualitatively explained from results on C_iE_j/water/alkane systems at atmospheric pressure by using either generalized ternary liquid-phase diagrams or a model that considers micelle-micelle and micelle-fluid interactions. Increasing pressure up to 550 bar acts to shrink the various two-component phase envelopes which govern the phase behavior of the multicomponent system and thus increases stability. At constant dispersed-phase composition and temperature, the clearing pressure of the system depends on the ethane/propane ratio only via the fluid density, possibly due to the nearly ideal mixing behavior of these two alkanes at high pressure. The ramifications of the phase behavior for the choice of polymerization conditions are discussed.

44889 Reaction of cyclopropane, methylcyclopropane, and propylene with hydrogen on the (111) and (110)-(1×2) surfaces of iridium. Engstrom, J.R. (Sandia National Laboratories, Albuquerque, NM (USA)); Goodman, D.W.; Weinberg, W.H. *Journal of Physical Chemistry (USA)*, 94(1): 396-409 (11 Jan 1990). DOE Contract AC04-76DP00789.

The hydrogenation, isomerization, and hydrogenolysis of cyclopropane, methylcyclopropane, and propylene have been investigated on the (111) and (110)-(1×2) single-crystalline surfaces of iridium at reactant partial pressures from 0.4 to 10 Torr of hydrocarbon (P_{HC}) and between 20 and 500 Torr of hydrogen (P_{H_2}) and at surface temperatures from 375 to 700 K. Both the kinetics of the reaction (activation energies and preexponential factors) and the dependencies of the rates of reaction on the reactant partial pressures (apparent reaction orders) were examined in detail. Postreaction surface analysis revealed the presence of a carbonaceous residue, the coverage of which was found to vary with the reaction conditions. The reaction of cyclopropane and hydrogen resulted in both hydrogenation to propane and the hydrogenolysis to methane and ethane, with the hydrogenation channel dominating for temperatures below 500 K. The Ir(110)-(1×2) was greater by a factor between approximately 2 and 10. The hydrogenation of methylcyclopropane on both the Ir(111) and Ir(110)-(1×2) surfaces was found to be dominated by the production of n-butane. This result was interpreted qualitatively by invoking parallel reaction mechanisms for the production of n-butane and isobutane, with the n-butane channel exhibiting a higher apparent activation energy, thus, dominating at the higher temperatures. The hydrogenolysis of methylcyclopropane was found to be similar to that of cyclopropane on both surfaces. However, a selectivity difference was observed between the two surfaces for hydrogenolysis, the product distributions for the major reaction channels were $CH_4 + C_3H_8$ on Ir(111) and $CH_4 + C_2H_6 + C_3H_8$ on Ir(110)-(1×2).

44890 General solution of the ideal model of chromatography for a single-compound band. Golshan-Shirazi, S. (Univ. of Tennessee, Knoxville (USA)); Guiochon, G. *Journal of Physical Chemistry (USA)*, 94(1): 495-500 (11 Jan 1990).

A general analytical solution of the ideal model of chromatography for a single-compound band is derived. This solution is valid for any concave or convex isotherm but not for those that have an inflection point. This solution is applied to the case of a two-site adsorption model, with an equilibrium isotherm that is the sum of two Langmuir-type expressions, corresponding to each of the two sites. The isotherm for the higher energy site has a larger b coefficient (expressing the stronger solute-stationary phase affinity) and a lower saturation capacity than the isotherm for the lower energy site. As predicted by Giddings long ago, the two-site model accounts very well for the tailing that appears on the experimental band profiles, in the cases examined. Thus, tailing cannot be explained only by a slow kinetics of the retention process. The asymptotic solution of the ideal model and its properties are also discussed.

44891 Diffusion-limited $A+B\rightarrow 0$ reaction: Correlated initial condition. Lindenberg, K. (Institute for Nonlinear Science, R-002—Department of Chemistry, B-040, University of California, San Diego, La Jolla, CA (USA)); West, B.J.; Kopelman, R. *Physical Review, A (General Physics) (USA)*, 42(2): 890-894 (15 Jul 1990). DOE Contract FG03-86ER13606.

We find a time dependence different from that reported previously in the literature for the species concentration in the $A+B\rightarrow 0$ diffusion-limited reaction for dimensions $d<2$ when the A-B pairs are initially correlated. Whereas an uncorrelated initial distribution leads to the well-known decay law $\rho\sim t^{-d/4}$ for $d<4$ and $\rho\sim t^{-1}$ for $d\geq 4$, a correlated initial distribution leads to the decay law $\rho\sim t^{-(d+2)/4}$ for $d<2$ and $\rho\sim t^{-1}$ for $d\geq 2$. The decay is therefore more rapid in the correlated case and the critical dimension for "anomalous" behavior shifts from 4 to 2.

44892 Electronic structure and chemical bonding of the first row transition metal dichlorides, $MnCl_2$, $NiCl_2$, and $ZnCl_2$: A high resolution photoelectron spectroscopic study. Wang, L. (Department of Chemistry, University of California at Berkeley, Berkeley, CA (USA)); Niu, B.; Lee, Y.T.; Shirley, D.A. *Journal of Chemical Physics (USA)*, 93(2): 957-966 (15 Jul 1990). DOE Contract AC03-76SF00098.

High resolution He I (584 A) photoelectron spectra of $ZnCl_2$, $MnCl_2$, and $NiCl_2$ were measured using a high temperature supersonic molecular beam source. In $ZnCl_2$, vibrational structures were resolved, and spectroscopic constants were derived for the observed molecular ion states. A single ν_1 vibrational progression was observed for the $C\ ^2\Sigma^+_g$ state of $ZnCl^+_2$. A Franck–Condon factor calculation allowed us to obtain a Zn–Cl equilibrium bond length increase of 0.095(5) A and a ν_1 vibrational frequency of 290(8) cm^{-1}. For the open-shell molecules, $MnCl_2$ and $NiCl_2$, no vibrational structure could be resolved because of their very low bending frequencies. Transitions from the ligand orbital and metal d orbital ionizations were clearly resolved, with those of the d orbitals having considerably narrower band widths. Even though many final states are expected for ionization of the open-shell d orbitals, only a few states were observed. This was explained in $MnCl_2$ by the one-electron spin selection rule: $S_f=S_i\ \pm 1/2$. Besides the spin selection rule, a propensity toward high spin was proposed to account for the spectrum of $NiCl_2$. From the metal d orbital and ligand orbital splittings, the degree of covalent bonding was inferred to be in the order of: $MnCl_2>NiCl_2>ZnCl_2$.

44893 Stereochemical tuning of Cr(III) photophysics with N,N′,N″-tris(alkylamine)-1,4,7-triazacyclononane complexes. Perkovic, M.W. (Wayne State Univ., Detroit, MI (USA)); Endicott, J.F. *Journal of Physical Chemistry (USA)*, 94(4): 1217-1219 (22 Feb 1990).

The stereochemistry of coordinated ligands can dramatically affect the thermally activated relaxation of $(^2E)Cr(III)$. This effect is most clearly exemplified in the much shorter (by a factor of 4.4 × 10^5) ambient lifetime of the hexammine complex $Cr(TAE[9]aneN_3)^{3+}$ (where TAE = N,N′,N″-tris(aminoethyl) and [9]$eneN_3$ = 1,4,7-triazacyclononane) than to the very closely related $Cr(TAP[9]aneN_3)^{3+}$ (where TAP = N,N′,N″-tris(aminopropyl)). The large contrast in excited-state lifetimes may be due largely to ligand-promoted low-frequency vibrational modes which induce a trigonal distortion of the excited-state Cr(III) microenvironment. The tendency of these ligands to promote or inhibit such motion results

in one of the shortest and one of the longest ambient lifetimes, respectively, observed for chromium(III) hexaam(m)ines. Models suggest that a trigonal distortion would mix the d-orbital character and facilitate the rapid, nonradiative return to the ground electronic state.

44894 A study of the metastable dissociations of formate esters: A McLafferty rearrangement to a distonic radical cation. Zha, Qingmei (Univ. of Nebraska, Lincoln (USA)); Hayes, R.N.; Nishimura, Toshihide; Meisels, G.G.; Gross, M.L. *Journal of Physical Chemistry (USA)*, 94(4): 1286-1290 (22 Feb 1990). DOE Contract AC02-76ER02567.

The metastable dissociations of formate ester radical cations were studied by using both threshold photoelectron photoion coincidence and tandem mass spectrometry. Kinetic energy releases for the unimolecular fragmentations were obtained from both mass analyzed ion kinetic energy (MIKE) and time-of-flight spectra. An important dissociation property of propyl formate radical cation is that the appearance energies of the three major fragment ions [$C_3H_6^{\bullet+}$, $HC(OH)_2^+$, and m/z 60 ($^{\bullet}CH_2OCHOH^+$ and $C_3H_7OH^{\bullet+}$)] are the same as the ionization energy of the propyl formate molecule, resulting in the absence of a molecular ion in the braekdown graph. The three major fragment ions are all formed via rearrangement processes (stepwise McLafferty rearrangement) involving a common distonic intermediate. The rearrangements are exothermic and occur without an activation energy, a conclusion in agreement with that of Benoit, Harrison, and Lossing for the formation of $HC(OH)_2^+$. The heat of formation of the distonic intermediate formed by an β hydrogen atom transfer was determined to be <579 kJ mol^{-1}. The rearrangement also pertains to butyl formate and may be a characteristic of the unimolecular dissociations of larger alkyl formate ester radical cations at low internal energies.

44895 Kinetics and product vibrational energy disposal dynamics in the reaction of chlorine atoms with D_2S. Hossenlopp, J.M. (Columbia Univ., New York, NY (USA)); Hershberger, J.F.; Flynn, G.W. *Journal of Physical Chemistry (USA)*, 94(4): 1346-1351 (22 Feb 1990).

The reaction of chlorine atoms with D_2S, forming DCl and DS, has been investigated by using time-resolved infrared diode laser absorption spectroscopic probing of both the $D^{35}Cl$ and $D^{37}Cl$ product. The rate constant obtained by using the pseudo-first-order method was found to be 3.2 ($\pm$ 0.3) $\times$ 10^{-11} cm^3 molecule^{-1} s^{-1}. The vibrational energy distribution in the DCl fragment was also determined with 33 ($\pm$ 7)% of the product DCl formed in ν = 0, 56 ($\pm$ 7)% in ν = 1 and 11 ($\pm$ 3)% in ν = 2. These results are consistent with the known vibrational population inversion between the ν = O and ν = 1 states of DCl previously observed for this reaction. The advantage of using infrared absorption measurements, rather than infrared emission, to determine vibrational distributions is that the ν = O population can be directly measured. The relative vibrational populations were modeled by using two different prior functions, both of which led to linear surprisal plots.

44896 Normal-coordinate analyses of the ground and ^{3}MLCT excited states of tris(bipyridine)ruthenium(II). Mallick, P.K. (Marquette Univ., Milwaukee, WI (USA)); Danzer, G.D.; Lumpkin, R.S.; Kincaid, J.R.; Strommen, D.P. *Journal of Physical Chemistry (USA)*, 94(4): 1357-1366 (22 Feb 1990).

The resonance Raman and time-resolved resonance Raman (TR^3) spectra of the title compound and nine of its deuteriated derivatives as well as the ^{15}N and $^{15}N_2$-3,3′-$^2H_2$ analogues are reported. These data are used to refine the previously reported ground-state force field and to derive a corresponding force field for the anion-radical fragment of the ^{3}MLCT excited state. These force fields reproduce the observed frequencies with average errors of $\approx$ 1%. In addition, the derived fields adequately reproduce the observed shifts upon ^{3}MLCT-state formation, in general giving shifts of appropriate sign (some shifts are to higher frequencies) and approximately correct magnitudes. Finally, the excited-state normal-mode formulations (potential energy distributions) are compared with those derived for the ground-state species, and structural implications for the ^{3}MLCT state are discussed.

44897 ESR measurement of the pK_a of carboxyl radical and ab initio calculation of the carbon-13 hyperfine constant. Jeevarajan, A.S. (Univ. of Notre Dame, IN (USA)); Carmichael, I.; Fessenden, R.W. *Journal of Physical Chemistry (USA)*, 94(4): 1372-1376 (22 Feb 1990).

The pK_a value for the equilibrium $CO_2H \rightleftarrows H^+ + CO_2^-$ has been determined by ESR methods to be -0.2 ± 0.1. The positions of the hyperfine lines did not vary over the pH range 1.6-10 but were found to change continuously as the acid concentration was increased over the range pH 1.2 to about pH 0, where the intensity became too small for study. The change in average hyperfine constant followed the behavior expected for a simple equilibrium under the assumption that exchange of the acid proton is rapid. The ^{13}C hyperfine constants in aqueous solution were found to be 146.4 $\pm$ 0.1 G for CO_2^- and 166 $\pm$ 5 G for CO_2H. Ab initio molecular orbital calculations generally agree with the measured hyperfine constants and predict a higher value for the neutral form of the radical. ESR lines from a reduced oxalate radical containing ^{13}C were also detected.

44898 Role of local configurations in a Langmuir–Hinshelwood surface reaction: Kinetics and compensation. Kang, H.C. (Department of Chemical Engineering, University of California, Santa Barbara, Santa Barbara, California 93106 (USA)); Jachimowski, T.A.; Weinberg, W.H. *Journal of Chemical Physics (USA)*, 93(2): 1418-1429 (15 Jul 1990). DOE Contract FG03-89ER14048.

We have employed Monte Carlo sampling to calculate the rate coefficient of a Langmuir–Hinshelwood reaction between species *A* and *B* on a square lattice. The experimental situation that is simulated is the reaction between a *preadsorbed* overlayer of species *A* with species *B*. The preadsorbed overlayer of *A* is allowed to equilibrate prior to the adsorption of *B*. Upon adsorption of *B*, the initial reaction rate is calculated assuming that *A* is irreversibly adsorbed and immobile, and that the equilibrium between adsorbed *B* and gas-phase *B* is established much more rapidly than the time scale of the reaction between *A* and *B*. Reaction is allowed only between nearest-neighbor *AB* pairs. We examine the parametrization of the reaction rate coefficient into an effective activation energy and an effective preexponential factor.

44899 Isomers of niobium clusters: Direct spectroscopic evidence. Knickelbein, M.B. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Yang, S. *Journal of Chemical Physics (USA)*, 93(2): 1476-1477 (15 Jul 1990). DOE Contract W-31109-ENG-38.

We have reproduced kinetics results indicating that niobium clusters in the size range Nb_9–Nb_{12} are produced in two isomeric forms which possess widely different rates reactivity toward D_2. We have exploited this difference in reactivity to record photoionization efficiency spectra of the unreactive forms of Nb_9, Nb_{10}, and Nb_{12} as well of a mixture containing predominantly the reactive forms. We find that the photoionization thresholds measured for Nb_9 and Nb_{12} with the reactive forms of these species depleted via reaction with D_2 are shifted to higher energies compared those recorded without D_2 present. The photoionization threshold energies for both unreactive and reactive forms of Nb_{10} are approximately equal.

44900 Fine-structure selectivity in polyatomic reaction products: CN($X\ ^2\Sigma^+$,v=0,N=0,1)+O_2→NCO($\tilde{X}\ ^2\Pi_{3/2}$, 00^10,J,e/f)+O. Sonnenfroh, D.M. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Macdonald, R.G.; Liu, K. *Journal of Chemical Physics (USA)*, 93(2): 1478-1479 (15 Jul 1990). DOE Contract W-31109-ENG-38.

The reaction CN+O_2→NCO+O has been investigated in a crossed-molecular beam experiment at a collision energy of 0.76 kcal/mole. Internal state distributions of the ground state NCO($\tilde{X}\ ^2\Pi_{3/2}$, 00^10,J,e/f) products have been measured by laser-induced fluorescence. The rotational excitation is small. There is an observed preference in the population of the *K* doublet fine-structure states, $1f>1e$, and this preference is even stronger for low *J* states.

44901 Level crossing in liquids involving intermolecular electronic to vibrational energy transfer. Paige, M.E. (Department of Chemistry, University of California, Berkeley, California 94720 (USA)); Harris, C.B. *Journal of Chemical Physics (USA)*, 93(2): 1481-1488 (15 Jul 1990). DOE Contract AC03-76SF00098.

The A'/A state lifetime of I_2 in various deuterated hydrocarbon solvents has been determined from picosecond transient absorption spectra. The lifetime observed in the deuterated solvents is 2.0 times as long as that which has been measured in the corresponding undeuterated solvent. A mechanism involving intermolecular electronic to vibration energy transfer from the electronically excited I_2 to the solvent is proposed to explain this effect and the overall trend of shorter lifetime with increasing density of CH stretching modes.

44902 Crystal structure of $LINb(OCH_2CH_3)_6$: A precursor for lithium niobate ceramics. Eichorst, D.J. (Univ. of Illinois, Urbana-Champaign (USA)); Payne, D.A.; Wilson, S.R.; Howard, K.E. *Inorganic Chemistry (USA)*, 29(8): 1458-1459 (18 Apr 1990). DOE Contract AC02-76ER01198.

In the investigation of the sol-gel processing, it has been noted that this process provides a means of producing high-purity homogeneous material of the desired stoichiometric composition such as metal alkoxide complexes. Lithium niobate ceramics were produced by reaction of equimolar quantities of lithium ethoxide and niobium ethoxide. Evaporation of the ethanolic solution at room temperature produced crystals that were transparent and 2-5 mm in length. A complete crystallographic study of these crystals was carried out, and the results are presented herein. 12 refs., 2 figs.

44903 Kinetic analysis of free-radical reactions in the low-temperature autoxidation of triglycerides. Zhu, Jingmin (Oakland Univ., Rochester, MI (USA)); Sevilla, M.D. *Journal of Physical Chemistry (USA)*, 94(4): 1447-1452 (22 Feb 1990).

The kinetics of the low-temperature autoxidation of triglycerides has been investigated by electron spin resonance spectroscopy. After initial radical production, four reaction stages are found in the overall autoxidation of unsaturated lipids: (1) formation of peroxyl radicals by addition of molecular oxygen to the initial carbon radicals, (2) consumption of oxygen in the autoxidation cycle, (3) decay of the lipid peroxyl radical into allylic and pentadienyl radicals, and (4) recombination of the carbon-centered radicals. Peroxyl radical decay in saturated lipids follows second-order kinetics with an apparent activation energy of ca. 50 kJ/mol. The authors find that, for polyunsaturated lipids, even at quite low temperatures (120 K), the autoxidation process occurs readily and must be considered in the storage of biological samples.

44904 Carbon-13 NMR studies of CO adsorbed on supported platinum and palladium catalysts using magic angle sample spinning. Zilm, K.W. (Yale Univ., New Haven, CT (USA)); Hamilton, D.M.; Webb, G.G.; Haller, G.L.; Bonneviot, L. *Journal of Physical Chemistry (USA)*, 94(4): 1463-1472 (22 Feb 1990).

The ^{13}C solid-state NMR of ^{13}CO chemisorbed on supported Pt and Pd catalysts has been investigated by static and magic angle spinning (MAS) NMR methods. The observation of a significant Knight shift of the ^{13}C resonance by other workers is confirmed for both Pt and Pd catalysts. The sources of line broadening for the static pattern have been reinvestigated and the ultimate resolution by MAS methods has been tested. On Pd the CO is motionally narrowed by rapid diffusion on the surface at room temperature, giving a relatively narrow line unaffected by MAS. Several possibilities are discussed for the source of the shift distribution, including the effects of stable paramagnetic sites or a distribution in isotropic Knight shifts. These measurements and previous bulk susceptibility measurements are analyzed with respect to the resolution in other catalyst systems. Experimental support for a two-stage diffusion model in which the rate-limiting step is edge-to-face conversion is also discussed.

44905 Coadsorption of ethylene and potassium on Pt(111). 2. Influence of potassium on the decomposition of ethylene. Windham, R.G. (Univ. of Colorado, Boulder (USA)); Koel, B.E. *Journal of Physical Chemistry (USA)*, 94(4): 1489-1496 (22 Feb 1990).

The effect of preadsorbed potassium on the decomposition of ethylene on the Pt(111) single-crystal surface has been studied by temperature programmed desorption (TPD) and high-resolution electron energy loss spectroscopy (HREELS). Potassium decreases the amount of ethylene decomposition and increases the activation energy for C-H bond cleavage. At 300 K and $\theta_K = 0.12$ monolayer, we observe a metastable intermediate in the decomposition of ethylene to form ethylidyne, which we propose to be ethylidene ($CHCH_3$). Complete dehydrogenation of ethylene occurs with an activation energy similar to that for breaking the first C-H bond, without forming a stable ethylidyne species. The authors suggest that the strong influence of potassium on the activation energies of these surface reactions, i.e., the inhibition of dehydrogenation of surface hydrocarbons, is due to the destabilization of carbon-metal σ bonds in the dehydrogenated hydrocarbons species due to charge transfer from potassium to platinum.

44906 Copper overlayers on rhenium(0001). He, J.W. (Texas A & M Univ., College Station (USA)); Goodman, D.W. *Journal of Physical Chemistry (USA)*, 94(4): 1496-1501 (22 Feb 1990).

The interaction of Cu overlayers with a Re(0001) surface has been studied by low-energy electron diffraction (LEED), Auger electron spectroscopy (AES), thermal desorption spectroscopy (TDS), and electron energy loss spectroscopy (ELS). The thermal desorption spectra of Cu from Re(0001) indicate two desorption peaks, designated as β_1 and β_2 states. The β_1 state begins to appear upon saturation of the β_2 state. Both states follow approximate zero-order kinetics. The activation energy for the β_1 and β_2 states is estimated from TD spectra to be $\approx$ 74 and $\approx$ 93 kcal/mol, respectively. AES measurements show that with Cu coverages less than 2 monolayers (ML), the Cu to Re AES ratios remain constant upon annealing to 1000 K. At higher coverages of Cu, the Cu/Re AES ratios decrease when annealed between 110 and 900 K, consistent with the formation of 3-D Cu clusters. Some Cu nucleation appears to take place during the deposition at 110 K. Several surface phases are observed by LEED following Cu deposition at 110 K and subsequent annealing.

44907 Photoionization studies of transition metal clusters: Ionization potentials for Fe_n and Co_n. Yang, S. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Knickelbein, M.B. *Journal of Chemical Physics (USA)*, 93(3): 1533-1539 (1 Aug 1990). DOE Contract W-31109-ENG-38.

The photoionization efficiency (PIE) spectra for cold iron clusters (Fe_6–Fe_{90}) and cobalt clusters (Co_3, Co_7–Co_{92}) have been measured using a tunable ultraviolet laser combined with time-of-flight mass spectrometry. Vertical ionization potentials (IPs) assigned from the observed photoionization thresholds decrease rapidly but nonmonotonically for both Fe_n and Co_n up to n=20, beyond which IPs evolve more slowly and smoothly. The measured IPs for both iron and cobalt clusters are lower than those predicted by the conducting spherical droplet model. The evolution of IP with increasing cluster radius R is observed to occur more gradually than the R^{-1}dependence predicted by this model. This suggests that the Fermi energy for clusters in this size range decreases with increasing cluster size. The shapes of the PIE spectra near threshold are observed to continuously evolve with increasing cluster size, with the smallest clusters displaying photoionization efficiencies which rapidly increase with energy above threshold, and larger clusters displaying spectra with more gradual slopes. It is proposed that this trend reflects the evolution in the density and distribution of low-lying electronic states which occurs with increasing cluster size.

44908 Ce-catalyzed oxidation of Ta(110). Gu, C. (Department of Physics, Ames, IA (USA)); Lynch, D.W.; Yang, A.B.; Olson, C.G. *Physical Review, B: Condensed Matter (USA)*, 42(3): 1526-1532 (15 Jul 1990). DOE Contract W-7405-ENG-82.

Photoemission spectroscopy was used to investigate the initial oxidation of the Ce/Ta(110) interface at room temperature. The oxidation of Ta(110) is dramatically enhanced by a thin Ce overlayer. A Ta suboxide TaO_χ ($0.5 \leq \chi \leq 1$) is formed first in the interface, followed by the rapid formation of Ta_2O_5 upon further oxygen exposure. A weak interface reaction exists in Ce/Ta(110), but is excluded as the main cause of the catalytic oxidation. An earlier suggestion is reconfirmed that the Ce layer converts O_2 to oxygen ions and thus promotes the oxidation of the substrate.

44909 Preparation and characterization of $(C_5Me_5)Rh(CNR)_2$ and $[(C_5Me_5)Rh(CNR)]_2$ complexes. Jones, W.D. (Univ. of Rochester, NY (USA)); Duttweiler, R.P. Jr.; Feher, F.J. *Inorganic Chemistry (USA)*, 29(8): 1505-1511 (18 Apr 1990). DOE Contract FG02-86ER13569.

Several complexes of the type $(C_5Me_5)M(CNR)X_2$ have been prepared, where M = Rh and Ir, X = Cl, Br, and I and R = Me, t-Bu, neo-Pn, i-Pr, 2,6-xylyl, and CH_2-adamantyl. Two members of this series have been structurally characterized. The crystal structures of $(C_5Me_5)Rh(CrMe)Cl_2$ and $(C_5Me_5)Ir(Cn\text{-}2,6\text{-}xylyl)I_2$ are reported. Reduction of the dihalide derivatives in the presence of isocyanide provides a general route to the bis-substituted products $(C_5Me_5)Rh(CNR)_2$ (R = Me, t-Bu, neo-Pn, i-Pr, 2,6-xylyl, CH_2-adamantyl). Reduction of the dihalide complexes in the absence of added isocyanide gives the dimers $[(C_5Me_5)Rh(\mu\text{-}CNR)]_2$, one of which has been characterized by x-ray crystallography (R = 2,6-xylyl). 25 refs., 3 figs., 6 tabs.

44910 Adsorption of hydrogen, carbon monoxide, and nitrogen on rhenium(0001) and copper overlayers on rhenium(0001). He, J.W. (Texas A & M Univ., College Station (USA)); Goodman, D.W. *Journal of Physical Chemistry (USA)*, 94(4): 1502-1508 (22 Feb 1990).

The interaction of hydrogen, carbon monoxide, and nitrogen with Re(0001) and with Re(0001) covered with submonolayer to multilayer Cu has been studied by thermal desorption spectroscopy (TDS) and low-energy electron diffraction (LEED). The adsorption of H_2 on clean Re(0001) induces a 2 x 2 superstructure that can be produced by H_2 exposure over a wide temperature range (110-300 K). cu deposition on Re(0001) induces a new hydrogen desorption state with a higher bonding energy than that from bulk Cu. Cu overlayers result in the attentuation of the H_2 desorption peak associated with the Re substrate. Adsorption of CO on a Re(0001) surface with varying amounts of Cu shows that at low Cu coverages (< 2 ML), a new desorption state is present, with a corresponding binding energy higher than that for bulk Cu and lower than that for clean Re(001). This state is interpreted to correspond to CO adsorbed at Cu sites perturbed by the underlying Re. At higher Cu coverages (≈ 5 ML), the CO TDS features are essentially the same as those found for bulk Cu. No new TDS states of nitrogen have been observed following nitrogen adsorption on Cu-covered Re. The TDS features from the Re substrate are greatly reduced by Cu deposition, consistent with Cu serving as a simple site-blocking agent to the adsorption and dissociation of nitrogen on Re.

44911 Geometries and energy separations of low-lying electronic states of Ag_4 and Cu_4. Balasubramanian, K. (Arizona State Univ., Tempe (USA)); Feng, Ping Yi. *Journal of Physical Chemistry (USA)*, 94(4): 1536-1544 (22 Feb 1990).

Complete active space self-consistent-field calculations (CASSCF) followed by POLCI and multireference single + doubles CI (MRSDCI) calculations, which included all $(n - 1)d^{10}ns^1$ electrons, are carried out on 14 electronic states of Ag_4 and the three low-lying electronic states of Cu_4. The ground states of both Cu_4 and Ag_4 are found to be of $^1A_1$ symmetry with rhombic geometries. The MRSDCI calculations included up to 430,000 configurations. The nature of the various states was analyzed through the CI wave functions and the Mulliken population analyses of the MRSDCI natural orbitals. The Mulliken populations of both Cu_4 and Ag_4 reveal consdierable participation of the 4p and 5p orbitals of the metal atoms in addition to the s orbitals of the metal atom in the bonding. The periodic trends in the geometries, binding energies, and ionization potentials of Cu_4, Ag_4, and Au_4 show that relativistic effects stabilize the metal-metal bonding to a considerable extent in Au_4. The effects of spin-orbit coupling are also obtained through the relativistic CI methodology. The barrier to convert the acute rhombic structure to the obtuse structure in the $^1A_1$ surface was calculated as 1.11 eV for Ag_4.

44912 Interaction of Mn with the Ru(001) surface and chemisorption of CO on the Mn/Ru(001) interface. Hrbek, J. (Brookhaven National Lab., Upton, NY (USA)). *Journal of Physical Chemistry (USA)*, 94(4): 1564-1570 (22 Feb 1990). DOE Contract AC02-76CH00016.

The interaction of vapor-deposited Mn with the Ru(001) surface and its effect on CO chemisorption were studied under ultrahigh vacuum by Auger electron spectroscopy (AES), thermal desorption spectroscopy (TDS), isotopic exchange, and low-energy electron diffraction (LEED). At room temperature, Mn grows layer by layer. The first three layers are pseudomorphic with respect to the Ru substrate. A complete analysis of Mn thermal desorption data shows that there is a decrease of the heat of adsorption with increasing coverage within the first monolayer (59 to 55 kcal/mol) and zero-order desorption for higher coverages with desorption energy 54 kcal/mol. A new, higher temperature CO desorption state at 650-800 K appears at submonolayer coverages. The C-O bond of CO chemisorbed on Mn/Ru is severely weakened and probably dissociated as evidenced by a high CO desorption temperature and random isotope mixing of coadsorbed isotopes of carbon monoxide.

44913 Complex kinetics of systems with multiple stationary states at equilibrium. Chu, X.-L. (Department of Chemistry, Stanford University, Stanford, California 94305 (USA)); Ross, J. *Journal of Chemical Physics (USA)*, 93(3): 1613-1625 (1 Aug 1990).

We consider chemical reactions which at equilibrium have multiple stationary states due to nonidealities of chemical species. When such reactions are included in a simple reaction mechanism open to mass flow, without autocatalysis or feedback steps, there may occur complex dynamics such as relaxation oscillations, as reported earlier for regular solutions. Here we consider both regular solution and ionic species (Debye–Hueckel nonideality), show that chemical oscillations may occur arbitrarily close to chemical equilibrium, and trace the topological structure of the complex dynamics of relaxation oscillations, sustained oscillations, stable focus, and stable nodes to the multiplicity of equilibrium states, for stated constraints. Relaxation oscillations occur around an unstable stationary state which, on approach to equilibrium, connects to an unstable equilibrium state. Thus, there is no bifurcation to oscillations on removing the systems from equilibrium. Neither is there a region where linear irreversible thermodynamics is valid close to equilibrium. Earlier work on ionic systems is found to be in error.

44914 Solid-state chemistry of molecular metal oxide clusters. Bis(triphenylphosphine)rhodium(I) carbonyl derivatives. Siedle, A.R. (3M Corporate Research Labs., St. Paul, MN (USA)); Gleason, W.B.; Newmark, R.A.; Skarjune, R.P.; Lyon, P.A.; Markell, C.G.; Hodgson, K.O.; Roe, A.L. *Inorganic Chemistry (USA)*, 29(9): 1667-1673 (2 May 1990).

Hydronium salts of the Keggin-type $XM_{12}O_{40}$ molecular metal oxide cluster anions $SiW_{12}O_{40}^{4-}$, $SiMo_{12}O_{40}^{4-}$, $PW_{12}O_{40}^{3-}$, $PMo_{12}O_{40}^{3-}$, $PMo_{12}O_{40}^{4-}$, and $PVMo_{11}O_{40}^{4-}$ react with $[(Ph_3P)_3Rh(CO)][HC(SO_2CF_3)_2]$ in $CH_3CN-C_2H_5OH$ to form $[trans\text{-}(Ph_3P)_2Rh(CO)(CH_3CN)]_nXM_{12}O_{40}$. These salts lose CH_3CN on heating to provide $[(Ph_3P)_2Rh(CO)]_nXM_{12}O_{40}$, which may also be obtained directly from $[(Ph_3P)_3Rh(CO)][HC(SO_2cF_3)_2]$ in pure ethanol. These oxometalates have been characterized by ir, NMR, and x-ray absorption spectroscopy and are considered to contain isolated, lattice-stabilized $(Ph_3P)_2Rh(CO)\text{-}(CH_3CN)^+$ and $(Ph_3P)_2Rh(CO)^+$ cations, with the latter being a three-coordinate, 14-electron Rh(I) species. The activity and selectivity of these compounds as catalysts for olefin isomerization and hydroformylation are described. Reaction of $[(Ph_3P)_3Rh(CO)][HC(SO_2CF_3)_2]$ with CH_3CN produces $[trans\text{-}(Ph_3P)_2Rh(CO)(CH_3CN)][HC(SO_2CF_3)_2]$. The crystal structure of the triclinic compound is reported. 41 refs., 4 figs., 8 tabs.

44915 Solubility of $CoCl_2$ in molten NaCl-$AlCl_3$. Wai, Chien (Argonne National Lab., IL (USA)); Bloom, I.; Caveny, D.; Blander, M. *Journal of Physical Chemistry (USA)*, 94(4): 1666-1669 (22 Feb 1990). DOE Contract W-31-109-ENG-38.

Measurements of the solubility of $CoCl_2$ (in mole fraction units) in molten NaCl-$AlCl_3$ solutions ranged from 2.2×10^{-4} to 6.15×10^{-2} in solvent compositions ranging from a mole fraction of $AlCl_3$ (X_{AlCl_3}) of 0.502-0.669. The steep increase in the solubility of $CoCl_2$ as a function of X_{AlCl_3} is well-represented by the coordination cluster theory. A solubility product (in ion fraction units) for $CoCl_2$ of 4.7×10^{-15} is deduced from the measurements. The

insolubility of $CoCl_2$ near the 50-50 solvent composition is a consequence of the fact that the complexing of solid $CoCl_2$ by $AlCl_3$ to form $Co(AlCl_4)_2$ in solution is considerably weaker than the complexing of 2NaCl(1) to form $2NaAlCl_4$(1).

44916 Representation of standard chemical thermodynamic properties of isomer groups by equations. Alberty, R.A. (Massachusetts Institute of Technology, Cambridge (USA)); Chou, Kuochih. *Journal of Physical Chemistry (USA),* 94(4): 1669-1674 (22 Feb 1990).

Since the standard chemical thermodynamic properties of isomer groups in a homologous series are found to be linear functions of the number of carbon atoms, the number of parameters required to represent them as a function of temperature and carbon number is greatly reduced. The existing tables for $C_p^0(I_n)$, $S^0(I_n)$, and the enthalpy of formation of the isomer group I_n at temperature T with respect to the elements at 298.15 K for seven isomer groups of the alkylbenzenes (C_6H_6 to $C_{12}H_{18}$) from 298.15 to 1000 K have been fitted by least squares to a set of equations containing 12 parameters. These parameters, plus five each for graphite and molecular hydrogen, can be used to calculate all of the standard chemical thermodynamic properties of these isomer groups in the ideal gas state. This makes it convenient to calculate the various thermodynamic properties for any carbon number and temperature in the range used, and also to estimate thermodynamic properties at carbon numbers higher than 12.

44917 NaSO→NaOS potential energy hypersurface. Jin, S. (Center for Computational Quantum Chemistry, University of Georgia, Athens, Georgia 30602 (USA)); Schaefer, F. III. *Journal of Chemical Physics (USA),* 93(3): 1799-1804 (1 Aug 1990). DOE Contract FG09-87ER13811.

For the ground and first excited electronic states of NaOS three minima and three transition states for interconversion have been determined by means of self-consistent field (SCF) and single and double excitation configuration interation (CISD) analytic gradient methods. The relationships between these structures have been clarified by vibrational analyses of the transition states. One of the NaOS equilibrium geometries is linear and the other two are bent. The chemical bonds between the two component parts of NaOS, Na and SO, for both $^2A'$ and $^2A''$ bent structures have ionic character, although differing in degree. In all studies both double-zeta-plus polarization and triple-zeta-plus double polarization basis sets were used.

44918 *Ab initio* transition state theory calculations of the reaction rate for $OH+CH_4 \rightarrow H_2O+CH_3$. Truong, T.N. (Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemistry); Truhlar, D.G. *Journal of Chemical Physics (USA),* 93(3): 1761-1769 (1 Aug 1990).

We have carried out *ab initio* calculations using Moller–Plesset perturbation theory, scaling all correlation energy in second order (MP-SAC2) with several large basis sets, for the reaction $OH+CH_4 \rightarrow H_2O+CH_3$. We found that correlation has a large effect on the geometry, barrier height, and vibrational frequencies of the transition state. The final calculated values, obtained with a correlation-balanced basis set, for the forward and reverse classical barrier heights are 7.9 and 21.2 kcal/mol, respectively. We have used these with transition state theory and an Eckart model for semiclassical tunneling calculations of the rate constants for the above reaction in the temperature range from 200 to 2000 K. We found that the present model, which requires information only at the reactants, transition state, and products, predicts rate constants of the same order of magnitude as the experimental data for this wide temperature range.

44919 Ground-state and excited-state properties of monometallic and bimetallic complexes based on rhenium(I) tricarbonyl chloride: Effect of an insulating vs a conducting bridge. Van Wallendael, S. (Univ. of North Carolina, Charlotte (USA)); Shaver, R.J.; Rillema, D.P.; Yoblinski, B.J.; Stathis, M.; Guarr, T.F. *Inorganic Chemistry (USA),* 29(9): 1761-1767 (2 May 1990). DOE Contract FG05-84ER13263.

The preparation and properties of monometallic and bimetallic complexes of rhenium(I) tricarbonyl chloride coordinated to 4,4′-dimethyl-2,2′-bipyridine ($(CH_3)_2$bpy), 2,2′-bipyrimidine (bpm), 2,3-bis(2-pyridyl)pyrazine (bpp), and 1,2-bis(4′-methyl-2,2′-bipyridyl-4-yl)ethane (Mebpy-Mebpy) are described. The CO stretching frequencies were in accord with facial geometry for the complexes. The NMR properties revealed that protons on the carbon atoms α to the coordinating nitrogen atoms of coordinated heterocycles were deshielded and shifted downfield. Electrochemically, one or two irreversible oxidations, a reversible reduction assignable to reduction of the heterocyclic ligand, and a second reduction (irreversible) at a potential more negative than that of the first were observed. The monometallic complexes displayed $d\pi \rightarrow \pi^*$ transitions in the 360-380-nm region. The transition red-shifted to 454 nm for $[(bpp)(Re(CO)_3Cl)_2]$ and to 480 nm for $[(bpm)(Re(CO)_3Cl)_2]$ but remained at 366 nm for $[(Mebpy\text{-}Mebpy)(Re(CO)_3Cl)_2]$. Emission was observed at room temperature for $[((CH_3)_2bpy)Re(CO)_3Cl]$, $[(Mebpy\text{-}Mebpy)Re(CO)_3Cl]$, $[(bpp)Re(CO)_3Cl]$, and $[(Mebpy\text{-}Mebpy)(Re(CO)_3Cl)_2]$. Their emission maxima were located near 600 nm except for $[(bpp)Re(CO)_3Cl]$. Its emission maximum was observed at 700 nm. 33 refs., 7 figs., 6 tabs.

44920 New syntheses of xenon hexafluoride (XeF_6) and xenon tetrafluoride (XeF_4). Nielsen, J.B. (Los Alamos National Lab., NM (USA)); Kinkead, S.A.; Purson, J.D.; Eller, P.G. *Inorganic Chemistry (USA),* 29(9): 1779-1780 (2 May 1990).

High yield methods for preparing high-purity XeF_6 and XeF_4 at relatively low pressures are described. A hot wire reactor was used for the preparation of XeF_6 by the direct reaction of xenon with fluorine at low pressures and high filament temperatures. Xenon tetrafluoride was prepared in quantitative yield and very high purity at low pressure and temperature by the reaction of O_2F_2 with xenon. The reaction initially converts all the xenon to a mixture of XeF_2 and XeF_4, and prolonged exposure of this mixture of O_2F_2 further fluorinates the remaining Xe(II) to Xe(IV).

44921 Solution and solid-state structures of the monomeric, piano-stool mono(peralkylcyclopentadienyl)vanadium(IV) trihalides. Hammer, M.S. (Univ. of Iowa, Iowa City (USA)); Messerle, L. *Inorganic Chemistry (USA),* 29(9): 1780-1782 (2 May 1990).

The method recently reported by Herberhold and co-workers for the high-yield preparation of $(C_5Me_5)VX_3$ (X = Cl, Br or I) by direct halogenation of $(C_5Me_5)V(OCO)_4$ has been reproduced by the authors. Spectroscopic and spectrometric data for the (C_5Me_5) and C_5Me_4Et compounds and the solid-state molecular structure of $(\eta\text{-}C_5Me_4Et)VCl_3$ are reported. 21 refs., 1 fig., 4 tabs.

44922 *Ab initio* multireference configuration interaction study of CH_2NNO_2. HONO elimination vs NN bond fragmentation. Mowrey, R.C. (Naval Research Laboratory, Washington, DC 20375-5000 (USA)); Page, M.; Adams, G.F.; Lengsfield, B.H. III. *Journal of Chemical Physics (USA),* 93(3): 1857-1864 (1 Aug 1990).

Features of the potential energy surface pertinent to the thermal decomposition mechanism of methylenenitramine (CH_2NNO_2) are investigated. At issue are the activation energies both for concerted molecular dissociation leading to HCN and HONO and for the simple NN bond cleavage leading to CH_2N and NO_2. We use multiconfiguration (MC)SCF wave functions with double-zeta and double-zeta plus polarization quality basis sets to locate minimum energy and transition state structures as well as determine harmonic vibrational frequencies and resulting zero-point vibrational energies. The energetics are determined using configuration interaction wave functions which include single and double excitations from a selected set of reference configurations constructed with the MCSCF molecular orbitals. Our best calculations, without adjustment, predict the molecular dissociation to have an activation energy slightly lower than that for simple bond rupture. Calculations at the level of those reported here are known, however, to underestimate bond dissociation energies by several kcal/mol. Based on trends from past calculations, and new calculations on a related compound, we estimate the activation energy for the HONO elimination path to be 31 ± 4 kcal/mol and the NN bond dissociation energy to be 35 ± 4 kcal/mol. This reverses the energetic ordering of previous theoretical predictions and is consistent with recent molecular beam experiments.

44923 Liquid to solidlike transitions of molecularly thin films under shear. Gee, M.L. (University of California, Santa Barbara, California 93106 (USA). Department of Chemical and Nuclear Engineering); McGuiggan, P.M.; Israelachvili, J.N.; Homola, A.M. *Journal of Chemical Physics (USA),* 93(3): 1895-1906 (1 Aug 1990). DOE Contract FG03-87ER45331.

We have measured the shear forces between two molecularly smooth solid surfaces separated by thin films of various organic liquids. The aim was to investigate the nature of the transitions from continuum to molecular behavior in very thin films. For films whose thickness exceeds ten molecular diameters both their static and dynamic behavior can usually be described in terms of their bulk properties, but for thinner films their behavior becomes progressively more solidlike and can no longer be described, even qualitatively, in terms of bulk/continuum properties such as viscosity. The solidlike state is characterized by the ordering of the liquid molecules into discrete layers. The molecular ordering is further modified by shear, which imposes a preferred orientation. All solidlike films exhibit a yield point or critical shear stress, beyond which they behave like liquid crystals or ductile solids undergoing plastic deformation. Our results on five liquids of different molecular geometry reveal some very complex thin-film properties, such as the quantization of various static and dynamic properties, discontinuous or continuous solid–liquid transitions, smooth or stick–slip friction, and two-dimensional nucleation. Quantitatively, the "effective" viscosity in molecularly thin films can be 10^5 times the bulk value, and molecular relaxation times can be 10^{10} times slower. These properties depend not only on the nature of the liquid, but also on the atomic structure of the surfaces, the normal pressure, and the direction and velocity of sliding. We also conclude that many thin-film properties depend on there being two surfaces close together and that they cannot be understood from a consideration of a single solid–liquid interface.

44924 μ-Oxo-bis(oxo) dinuclear complexes of technetium(V) with amine phenol ligands: Syntheses, characterization, and x-ray crystal structures. Pillai, M.R.A. (Bhabha Atomic Research Center, Bombay (India)); Lo, J.M.; John, C.S.; Schlemper, E.O.; Troutner, D.E. *Inorganic Chemistry (USA),* 29(10): 1850-1856 (16 May 1990). DOE Contract FG02-86ER60400.

Technetium(V) complexes of three amine phenol ligands prepared by reducing Schiff bases derived from salicylaldehyde and 1,3-diaminopropane, 2,2-dimethyl-1,3-diaminopropane, and 1,4-diaminobutane have been synthesized. ^1H and proton-decoupled ^{13}C nuclear magnetic resonance spectra of the complexes have been recorded and compared with those of the parent ligands. The complexes have been characterized by infrared spectroscopy, visible-UV spectrophotometry, and x-ray crystallography. X-ray crystal structures show all three complexes are dinuclear with a μ-oxo-bis(oxo) (O=Tc-O-Tc=O) backbone. The distorted octahedral coordination of Tc(V) is completed by a tetradentate diamine diphenolate ligand. Neutrality of the complexes is achieved by deprotonation of the phenols and by terminal and bridging oxo ligands. The technetium complexes have either a true crystallographic center of symmetry or an approximate center at the bridging oxygen. 16 refs., 4 figs., 10 tabs.

44925 The two-state model applied to high pressure mobility results for 2,2,4-trimethylpentane. Berlin, Y.A. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973 (USA)); Holroyd, R.A. *Journal of Chemical Physics (USA),* 93(3): 1939-1941 (1 Aug 1990). DOE Contract AC02-76CH00016.

The behavior of the electron mobility in 2,2,4-trimethylpentane at high pressure is analyzed in the framework of the two-state model of electron transport. The increase in mobility at 22.5°, as the pressure increases, is shown to be correlated with an increase in μ_F, the free state mobility. The probability of localization first decreases slightly then increases slightly with pressure. Although both the conduction band energy V_0 and the trapped state energy E_t increase with pressure, the difference $V_0 - E_t$ is shown to remain constant.

44926 Excited-state absorption spectroscopy and spectroelectrochemistry of tetrakis(2,2′-bipyridine)(μ2,3-bis(2-pyridyl)pyrazine)diruthenium(II) and its mononuclear counterpart: A comparative study. Berger, R.M. (Univ. of Notre Dame, IN (USA)). *Inorganic Chemistry (USA),* 29(10): 1920-1924 (16 May 1990).

Excited-state absorption spectra of the complexes $[(bpy)_2Ru(dpp)Ru(bpy)_2]^{4+}$ and $[Ru(bpy)_2(dpp)]^{2+}$ (bpy = 2,2′-bipyridine, dpp = 2,3-bis(2-pyridyl)pyrazine) in ethanol have been obtained. The excited-state spectra of both complexes exhibit bands in the near-uv region (350 nm for the binuclear complex and 370 nm for the mononuclear complex). In the visible region, a residual metal-to-ligand charge-transfer transition from the remaining Ru(II) center of the binuclear complex to the second lowest π^* orbital of the dpp ligand occurs. No comparable band appears in the spectrum of the mononuclear complex. Weak bands also occur in the 610-630-nm region in both complexes. The excited states of the binuclear and mononuclear complex decay with lifetimes of 80 ± 10 and 210 ± 20 ns, respectively, and both complexes emit in room-temperature ethanol solution (ϕ = 0.0012 ±0.0003 and 0.011 ± 0.001). Spectroelectrochemistry has been used to characterize the reduced forms of the complexes. The first reduction of each complex occurs at the dpp ligand, and the spectra of these singly reduced complexes resemble the excited-state spectra. There is, however, significantly more absorption in the 450-500-nm region for the reduced complexes, consistent with the presence of one or two Ru(II) centers capable of engaging in MLCT transitions. The second reduction of the binuclear complex occurs at the dpp ligand, while the second reduction of the mononuclear complex occurs at one of the bpy ligands. 55 refs., 4 figs.

44927 Influence of porphyrin radical type on V=O bond strength in vanadyl porphyrin cation radicals: Implications for heme protein intermediates. Macor, K.A. (Univ. of Notre Dame, IN (USA)); Czernuszewicz, R.S.; Spiro, T.G. *Inorganic Chemistry (USA),* 29(10): 1996-2000 (16 May 1990). DOE Contract AC02-81ER10861.

Resonance Raman spectra have been analyzed for vanadyl porphyrin cation radicals of octaethylporphyrin (OEP), meso-tetraphenylporphyrin (TPP), and meso-tetrametisylporphyrin (TMP). The strength of the metal-oxo bond in these cation radicals is demonstrated to be a function of radical type, a_{1u} or a_{2u}. Porphyrin ring mode ν_2, which has previously been shown to be a marker for the radical type was used to identify the radicals. The a_{1u} OV(OEP) radical exhibited an upshift in the V=O stretching frequency resulting from the increased positive charge on the porphyrin, which reduces the porphyrin → vanadium electron donation and increases the O → vanadium donation. ν(V=O) frequency decreases were observed for the a_{2u} OV(TPP) and OV(TMP) radicals. These can be explained on the basis of mixing of the porphyrin π a_{2u} orbital with the vanadium d_{z^2} and oxygen p_z orbitals, which is allowed in C_{4v} symmetry. This interaction decreases the bond strength in a $_{2u}$ cation radicals, since an electron is removed from an orbital with partial V-O σ-bonding character. Mixing of the porphyrin a_{1u} π orbital with metal or oxygen orbitals is forbidden. These results imply that porphyrin radical type is an important determinant of the Fe=O bond strength in heme protein cation-radical intermediates. 34 refs., 5 figs.

44928 Isothermal–isobaric molecular dynamics simulation of liquid water. Ruff, I. (Department of Chemistry, Purdue University, West Lafayette, Indiana 47907 (USA)); Diestler, D.J. *Journal of Chemical Physics (USA),* 93(3): 2032-2042 (1 Aug 1990). DOE Contract FG02-85ER60310.

Results of the first isothermal–isobaric molecular dynamics simulation of water are reported. Water molecules are assumed to be flexible and to interact via a sum of pairwise interatomic potentials. Extensive runs for 256 molecules at 298 and 373 K and 1 bar give satisfactory agreement with observed properties of liquid water as diverse as density, internal energy, heat capacity, compressibility, pair correlation functions, diffusion coefficient, vibrational spectrum, relative permittivity, and dielectric relaxation spectra. The nonlinear dependence of the relative permittivity on the electric field is also computed by means of fluctuation–dissipation relations.

44929 The layered, metallic scandium iodide $Sc_{0.93}I_2$: Synthesis, structure, and properties. McCollum, B.C. (Iowa state Univ., Ames (USA)); Dudis, D.S.; Lachgar, A.; Corbett, J.D. *Inorganic Chemistry (USA),* 29(10): 2030-2032 (16 May 1990).

The stoichiometry of the layered metallic scandium iodide $Sc_{0.93}I_2$, reported earlier is confirmed. The compound was prepared by the reaction of ScI_3 with excess metal over a sizeable temperature range; however, the composition was not detectably temperature dependent. Several properties of the material were measured, and the results are reported. The results of studies of the synthesis to clarify the structure through vapor-phase transport as well as Guinier powder and single crystal x-ray diffraction are reported. 21 refs., 2 tabs.

44930 $Ru_3(CO)_{12}$ interaction with Ru(001) and Au/Ru surfaces. Malik, I.J. (Brookhaven National Laboratory, Chemistry Department, Upton, New York 11973 (USA)); Hrbek, J. *Journal of Chemical Physics (USA)*, 93(3): 2156-2157 (1 Aug 1990).

We studied the interaction of $Ru_3(CO)_{12}$ with a Ru(001) surface and with Ru(001) covered with approximately 2 monolayers of Au(Au/Ru). We report IRAS (infrared reflection–absorption spectroscopy) and TDS (thermal desorption spectroscopy) results for $Ru_3(CO)_{12}$ adsorbed at these surfaces at coverages between ~0.2 monolayer (θ_{RC}~0.2) and θ_{RC}~10. IRAS spectra show sharp bands (FWHM~4 cm^{-1}) for $Ru_3(CO)_{12}$/Ru(001) at all studied coverages and for $Ru_3(CO)_{12}$/Au/Ru at θ_{RC} >3. IRAS results imply well-ordered adsorbate layers with the Ru_3-triangle of $Ru_3(CO)_{12}$ parallel to the surface. Infrared spectra of $Ru_3(CO)_{12}$/Au/Ru at θ_{RC} <~3 show broadening and splitting of the absorption bands. TDS results suggest a molecular adsorption of $Ru_3(CO)_{12}$ for coverages giving sharp IRAS bands and a possible fragmentation of $Ru_3(CO)_{12}$ at Au/Ru at low coverages.

44931 Palladium carbonyl clusters entrapped in NaY zeolite cages: Ligand dissociation and cluster-wall interactions. Sheu, Lienlung (Northwestern Univ., Evanston, IL (USA)); Knoezinger, H.; Sachtler, W.M.H. *Journal of the American Chemical Society (USA)*, 111(21): 8125-8131 (11 Oct 1989).

Highly structured FTIR spectra, which are indicative of Pd carbonyl clusters, are obtained after adsorption of CO on Pd/NaY which was reduced at 200°C, but broad IR bands are observed with samples which were reduced at higher temperatures. Pd carbonyl clusters with only CO ligands have not been reported previously, which indicates that the geometry of NaY supercages favors their formation. As the clusters lose some of their CO ligands, old IR bands erode and new IR bands with sharp isosbestic points emerge. This process is entirely reversed upon reintroduction of CO. The low activation energy of CO release and concomitant changes in the IR band characteristic of zeolite O-H vibrations indicate a chemical interaction of zeolite protons and Pd carbonyl clusters.

44932 Time-resolved IR spectroscopy in liquid rare gases: Direct rate measurement of an intermolecular alkane C-H oxidative addition reaction. Weiller, B.H. (Lawrence Berkeley Lab., CA (USA)); Wasserman, E.P.; Bergman, R.G.; Moore, C.B.; Pimentel, G.C. *Journal of the American Chemical Society (USA)*, 111(21): 8288-8290 (11 Oct 1989).

Since the first demonstration of the intermolecular oxidative addition of alkane C-H bonds to transition-metal centers, there have been many studies of the mechanism of this reaction. While these studies have illuminated many aspects of the C-H activation process, they do not provide direct information about the reactive intermediates or the potential energy surface for the elementary insertion reaction. Flash photolysis studies have been thwarted by extremely fast insertion rates in neat alkane solution and by the lack of a suitable inert and transparent solvent for dilution of the alkane. The authors have overcome these difficulties with the use of liquid rare gases as solvents. Using a novel combination of low-temperature and IR laser flash kinetic techniques, we are able to detect the C-H activating transient intermediate formed from $Cp^*Rh(CO)_2$ ($Cp^* = (\eta^5\text{-}C_5Me_5)$) and measure its rate of reaction with cyclohexane over a wide range of concentrations and temperatures.

4004 Electrochemistry

Refer also to citation(s) 44063, 44489, 46132, 46175

44933 (LBL–29118) **Cyclic voltammetry at a rotating disk, electroreduction of nitrate in acidic nickel solutions, and frequency-response analysis of porous electrodes.** Shain, P.M. Lawrence Berkeley Lab., CA (USA). Jun 1990. 227p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90015317. Source: NTIS, PC A11/MF A01 - OSTI; GPO Dep.

Models of electrochemical systems were developed to interpret experimental results. Linear sweep voltammetry and frequency-response analysis (electrochemical impedance spectroscopy) were the experimental techniques considered; the reduction of nitrate in acidic nickel solutions and the frequency response of redox couples in porous electrodes, the electrochemical systems. Linear sweep voltammetry has been used to study the kinetics of nitrate reduction acidic nickel solutions. This is a step in the manufacture of nickel battery electrodes and would also be important in the corrosion of steel by nitric acid. The reaction is interesting because negative ions react at the negative electrode. Bernardi studied this reaction with potential step and linear sweep voltammetry experiments. The voltammetry model was developed to explain the results of the latter. It was based on earlier work by Matlosz and Newman but allows for the participation of adsorbed species in the reactions. The assumption of a stagnant-diffusion layer was relaxed. The model accounts properly for the beginning of the sweep before the boundary layer develops.

44934 Extended X-ray absorption fine structure investigations of nickel hydroxides. Pandya, K.I. (Case Western Reserve Univ., Cleveland, OH (USA)); Hoffman, R.W.; O'Grady, W.E.; Corrigan, D.A.; McBreen, J. *Journal of Physical Chemistry (USA)*, 94(1): 21-26 (11 Jan 1990). DOE Contract AC02-76CH00016.

The extended X-ray absorption fine structure (EXAFS) technique was used to investigate the structures of α-$Ni(OH)_2$ and β-$Ni(OH)_2$ samples at room temperature and at liquid nitrogen temperature. The EXAFS data for β-$Ni(OH)_2$ were analyzed by using the reference phase and amplitude functions derived from the NiO and Ni foil EXAFS spectra. The EXAFS spectra of α-$Ni(OH)_2$ were analyzed by using NiO as well as β-$Ni(OH)_2$ as the reference compounds. A contraction in the Ni-Ni distance of 0.05 Å in the lattice of α-$Ni(OH)_2$ was observed in comparison to β-$Ni(OH)_2$. Analysis of in situ EXAFS spectra of an α-$Ni(OH)_2$ film indicated subtle changes upon hydration including an increase in the Ni-O coordination number.

44935 Rectifying bilayer electrodes: Layered conducting polymers on platinum. Torres, W. (Univ. of Texas, Austin (USA)); Fox, M.A. *Chemistry of Materials (USA)*, 2(3): 306-311 (May-Jun 1990).

The preparation of sequential bilayer structures made from any pair of polybithiophene, I, polypyrrole, II, and poly(3-bromothiophene), III, by anodic electropolymerization on platinum electrodes is described, and the electrochemical properties of the junction between the two conducting polymer are discussed. Voltammetric evidence shows that the polymers in the outer layers of the electrodes Pt/I/II and Pt/III/II can be trapped in the oxidized state and that charge can be released via an appropriate redox couple in solution. Geometrical relaxation and/or overoxidation induced at high anodic potentials significantly alter the shapes of the resulting voltammograms.

44936 Electrochemistry and photoelectrochemistry of pillared-clay-modified electrodes. Rong, Daiting (Univ. of Texas, Austin (USA)); Kim, Yeong Il; Mallouk, T.E. *Inorganic Chemistry (USA)*, 29(8): 1531-1535 (18 Apr 1990). DOE Contract FG05-87ER13789.

Clay-modified electrodes (CME) were made by binding $Al_{13}O_4(OH)_{28}^{3+}$-pillared montmorillonite to SnO_2 and Pt surfaces via a thin (2-4 monolayer thick) coating of polymerized silane. The polymer provides a binding site for multiply charged anions such as $Fe(CN)_6^{4-}$ and $Mo(CN)_8^{4-}$, while the clay external surface strongly binds large cations such as $Os(bpy)_3^{2+}$ and $Ru(bpy)_3^{2+}$. Charge-trapping behavior, which is a consequence of spatial ordering of the electroactive anions and cations, is observed in cyclic voltammetry of the CME in aqueous KH_2PO_4 solution. With $Ru(bpy)_3^{2+}$ exchanged onto the clay surface, photocathodic

currents are generated with a quantum efficiency (per photon absorbed) of ca. 1%. This photocurrent is attributed to electron donor quenching of the $Ru(bpy)_3^{2+}$ excited state by $Fe(CN)_6^{4-}$ or $Mo(CN)_8^{4-}$. 22 refs., 6 figs.

44937 Intramolecular electron transfer in the inverted region. Chen, Pingyun (Univ. of North Carolina, Chapel Hill (USA)); Duesing, R.; Tapolsky, G.; Meyer, T.J. *Journal of the American Chemical Society (USA)*, 111(21): 8305-8306 (11 Oct 1989).

In 1960 Marcus predicted that rate constants for electron transfer should decrease with -ΔG in the inverted region. In the inverted region, $-\Delta G > \lambda$, where λ is the reorganization energy and ΔG the free energy loss associated with the electron transfer. Experimental verification of this prediction has been difficult to obtain but has been found by pulse radiolysis in rigid organic glasses, by Closs, Miller, and co-workers in unsymmetrical, linked organics, in accounting for separation yields in photoinduced electron transfer, and by light-induced electron transfer in linked porphyrin-quinone systems. The authors report here the first examples based on transition-metal complexes and, as predicted theoretically, that there is a clear relationship between electron transfer in the inverted region and nonradiative decay in a closely related family of excited states.

4005 Photochemistry

Refer also to citation(s) 44693, 44787, 44851, 44863, 44881, 44885, 44886, 44936, 44947

44938 (DOE/ER/14039–T1) **Photochemistry of intermolecular C-H bond activation reactions: Progress report.** Lees, A.J. State Univ. of New York, Binghamton, NY (USA). 9 Aug 1990. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14039. Order Number DE90016095. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the first part of our DOE supported program we have undertaken a detailed study of the photochemistry of several transition-metal organometallic complexes which, on light excitation, activate the C-H bonds of hydrocarbon solvents. Steady-state laser photolysis and low-temperature spectroscopic measurements have been performed on the complexes $(\eta^5\text{–}C_5R_5)M(CO)_2$(M = Rh, Ir; R = H, Me), $(\eta^5\text{–}C_9R_7)Ir(CO)_2$($\eta^5$–$C_9H_7$ = idenyl) and $(\eta^5\text{–}C_5H_5)Re(CO)_2L$ (L = a pyridine derivative) under dilute solution conditions in deoxygenated alkane and aromatic solvents. In each system the solution photoreaction has been monitored by diode-array UV-visible and FTIR spectroscopy and C-H activation photoproducts have been further characterized by mass spectroscopy. Particular attention has been paid to the wavelength dependencies of these photochemical reactions and the optimum light excitation wavelengths for conversion to the hydrido photoproducts have been identified. 5 refs., 2 figs.

44939 (SAND–90-0800C) **Optical fiber interferometric sensors for chemical detection.** Butler, M.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009229–1: SPIE, chemical, biochemical and environmental fiber sensor symposium, San Jose, CA (USA), 16-20 Sep 1990). Order Number DE90015394. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Interferometric sensors take advantage of a unique property of light, its macroscopic coherence, which has resulted in extremely sensitive devices for the detection of physical parameters. In this paper I will discuss three new chemical detection mechanisms which utilize optical interferometric techniques. 15 refs., 11 figs.

44940 Quantum yields of photoionization in the 308-nm two-photon ionization of solutes in hydrocarbon solutions and their relationship to the observed conductivity signals. Schmidt, K.H. (Argonne National Laboratory, IL (USA)); Sauer, M.C. Jr.; Lu, Yuelie, Liu, Andong. *Journal of Physical Chemistry (USA)*, 94(1): 244-251 (11 Jan 1990). DOE Contract W-31-109-ENG-38.

A method is described for measuring the overall quantum yields for free ions in the two-photon ionization of solutes in hydrocarbon liquids and for extracting the quantum yield for production of free ions from solute excited states. The zero electric field quantum yields at 308 nm and 25°C for production of free ions from the singlet state of anthracene in n-hexane, cyclohexane, and isooctane (2,2,4-trimethylpentane) are 0.0023, 0.0058, and 0.017, respectively. Similarly, in isooctane, for the singlet states of fluoranthene, coronene, and TMPD (N,N,N′,N′-tetramethyl-p-phenylenediamine), the quantum yields are 0.0039, 0.023, and 0.028, respectively. All of these quantum yields are for solutions saturated with SF_6·; in n-hexane and cyclohexane decreasing the concentration of SF_6 by 2 orders of magnitude has no effect, but in isooctane the quantum yield of free ions increases by a factor of 2. The quantum yield results obtained with light of 308 nm are used in conjunction with measurements of the decay of conductivity due to the geminate ion pairs to obtain information on the distance distribution within the geminate pairs and the primary yield of photoionization. The analysis indicates that the primary quantum yields for ionization of the first excited singlet state of anthracene are approximately unit for isooctane and cyclohexane solutions, but may be as low as 0.4 for anthracene in n-hexane, and that an r^2 Gaussian or r^2 exponential distribution of separation distances explains the experimental observations better than an exponential distribution. Comparison with results obtained in radiolysis with electrons shows that the distribution of separation distances is narrower in the photochemical case, resulting in lower probability for separation into free ions.

44941 Solvent-tuned intramolecular charge-recombination rates in a conjugated donor-acceptor molecule. Khundkar, L.R. (Jet Propulsion Lab., Pasadena, CA (USA)); Stiegman, A.E.; Perry, J.W. *Journal of Physical Chemistry (USA)*, 94(4): 1224-1226 (22 Feb 1990).

The nonradiative charge-recombination rates from the charge-transfer state of a new conjugated donor-acceptor molecule (p-cyano-p′-methylthiodiphenylacetylene) can be tuned over almost an order of magnitude by varying the polarity of the solvent. These measurements of intramolecular recombination show a turnover of rates as a function of emission energy, consistent with the normal and inverted behavior of Marcus theory. Steady-state spectra and time-resolved measurements allow us to quantitatively compare thermal and optical electron-transfer rates as a function of driving force and demonstrate their correspondence.

44942 Excited-state transient of vanadyl uroporphyrin I detected by resonance Raman spectroscopy. Alden, R.G. (Univ. of New Mexico, Albuquerque (USA)); Sparks, L.D.; Ondrias, M.R.; Crawford, B.A.; Shelnutt, J.A. *Journal of Physical Chemistry (USA)*, 94(4): 1440-1443 (22 Feb 1990).

Transient Raman spectroscopy has been used to investigate excited states of vanadyl uroporphyrin I (VOUroP) in both monomeric and dimeric forms. Uroporphyrins are water-soluble porphyrins with propionic and acetic acid groups substituted at the β-pyrrole carbon positions. Monomeric VOUroP in aqueous solution is known to be six-coordinate with a ligand trans to the oxo ligand. Upon dimerization, the sixth ligand site is inaccessible, and a five-coordinate species is observed. At high laser fluence, an excited-state transient is formed in the monomeric species. Raman spectra of this species are most consistent with an $^2A_{1u}$ ($a_{1u}(\pi) \rightarrow d_{xy}$) charge-transfer state. In contrast, dimeric VOUroP shows little evidence of an excited state in the transient Raman spectra during a 10-ns laser pulse.

44943 Association of chlorophyll with inverted micelles of dodecylpyridinium iodide in toluene. Seely, G.R. (Arizona State Univ., Tempe (USA)); Ma, X.C.; Nieman, R.A.; Gust, D. *Journal of Physical Chemistry (USA)*, 94(4): 1581-1586 (22 Feb 1990).

Dodecylpyridinium iodide forms inverted micelles in water-containing toluene at concentrations higher than 10^{-4} M, as it reportedly does in other nonpolar solvents. Micelle formation is characterized by changes in the charge-transfer absorption band, and in the chemical shifts of protons, especially those on or near the pyridinium group. The micelles associate with chlorophyll a, also dissolved in the toluene, as evidenced by large changes in the chemical shift of some of the surfactant and the chlorophyll resonances. The fluorescence quantum yield of chlorophyll is little reduced by the presence of 10^{-3} M 2,2′-dithiobis(5-nitropyridine), a quencher which is soluble in toluene and probably associates weakly with the micelles, but is strongly reduced by the presence

of the bis(tetramethylammonium) salt of 5,5′-dithiobis(2-nitrobenzoic acid), which is solubilized only in the presence of the inverted micelles, and furthermore forms a complex with chlorophyll. These cationic inverted micelles constitute a new environment for the pursuit of chlorophyll model system investigations.

44944 Electric field effects in the photoionization of N_2 near threshold. Berkowitz, J. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Ruscic, B. *Journal of Chemical Physics (USA),* 93(3): 1741-1746 (1 Aug 1990). DOE Contract W-31109-ENG-38.

Structural features well below the usual Stark field depression of the ionization threshold are observed in the photoionization of N_2 in the presence of weak (10–15 V/cm) fields. The energies of the structural features can be simulated by assuming rotational autoionization ($\Delta J = -2$). They are interpreted as originating from Q (J'') transitions, forbidden to spontaneously autoionize in the absence of a field. The field relaxes the rigorous autoionization selection rules by l spoilage of the Rydberg electron. The effect appears accentuated for high J, low n^* states ($J \sim 27$, 28; $n^* \sim 23$) and quenches at $J \sim 11$, $n^* \sim 37$. The quenching is attributed to the onset of the Inglis–Teller effect.

44945 Photoionization of HBr and DBr near threshold. Ruscic, B. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Berkowitz, J. *Journal of Chemical Physics (USA),* 93(3): 1747-1754 (1 Aug 1990). DOE Contract W-31109-ENG-38.

Photoionization is observed in HBr (at 300 K) below the adiabatic threshold. The photoion yield curve has structure, and is independent of both pressure and electric field over a large range. The peaks can be simulated rather well by a model which assumes rotational autoionization, with $\Delta N \geq -4$. This model does not exclude concomitant processes with $\Delta N = -1, -2, -3$. A formal theory is also presented, which describes $\Delta N = -4$ as occurring through successive quadrupole transitions, in second-order perturbation theory. A tentative conclusion is drawn, based on preliminary studies of other molecules, that a type of rotational autoionization can occur in heteronuclear diatomic molecules without an electric field, and in homonuclear diatomic molecules with such a field. The photoionization of DBr has been studied with similar conditions. A corresponding simulation is in good agreement with the observed structure below the adiabatic threshold. In addition, one peak in a triad observed in HBr above threshold, and predicted by an MQDT calculation to be absent in DBr, is still observed.

44946 Photochemistry of semiconductor surfaces: In situ photoreduction of SnS_2. Force, R.K. (Univ. of Rhode Island, Kingston (USA)); Fessehaie, M.G.; Grosso, R.; McClain, S.; Willis, W.S.; Suib, S.L. *Inorganic Chemistry (USA),* 29(10): 1924-1929 (16 May 1990).

The in situ photoreduction of SnS_2 has been studied with x-ray photoelectron spectroscopy, residual gas analysis, photogravimetric analysis, and thermogravimetric analysis. The authors results suggest that photoreduction process is quite dependent on the amount of surface chloride ion that is left over during the commercial manufacture of SnS_2 from $SnCl_4$. In the presence of Cl^- ions there is partial reduction of Sn^{4+} to Sn metal, which only occurs in the presence of light. Thermal treatment of impure SnS_2 does not lead to reduction to Sn. When highly pure SnS_2 is irradiated, there is no measurable reduction. The nature of the support for the SnS_2 pellet is also important since photoreduction was observed for chloride-contaminated SnS_2 mounted on Al but not when Mow as used as a holder. Surface hydroxyl groups on the Al are believed to be partially responsible for the observed photoreduction of SnS_2. Finally, the photogravimetric analysis (PGA) method reported here is an excellent method for studies of light-sensitive materials. Their results suggest that impurity ions are responsible for the photoreduction of SnS_2 and that it may be possible to intentionally dope various semiconductors in order to initiate reduction. 31 refs., 4 figs., 3 tabs.

4006 Radiation Chemistry

Refer also to citation(s) 44027, 44049, 44050, 44056, 45609

44947 (DOE/ER/00038–3304) **Radiation Laboratory, University of Notre Dame quarterly report, April 1–June 30, 1990.** Notre Dame Univ., IN (USA). Radiation Lab. 20 Aug 1990. 33p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER00038. (Q–132). Order Number DE90016220. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report contains abstracts for reports released during the period of April 1st to June 30th, 1990 by the Radiation Laboratory of the University of Notre Dame. (JDL)

44948 (JAERI-M–90-054) **Annual report of the Osaka Laboratory for Radiation Chemistry Japan Atomic Energy Research Institute, 21: April 1, 1987 - March 31, 1988.** Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 62p. Order Number DE90513708. Source: NTIS (US Sales Only), PC A04/MF A01.

This report describes research activities of Osaka Laboratory for Radiation Chemistry, JAERI during one year period from April 1, 1987 through March 31, 1988. Detailed descriptions of the activities are presented in the following subjects: (i) studies on surface phenomena under electron and ion irradiations and (ii) studies on radiation chemistry of high polymers and radiation dosimetry. (J.P.N.).

44949 Stochastic modeling of fast kinetics in a radiation track. Green, N.J.B. (Physical Chemistry Laboratory, Oxford (England)); Pilling, M.J.; Pimblott, S.M.; Clifford, P. *Journal of Physical Chemistry (USA),* 94(1): 251-258 (11 Jan 1990).

A method is presented for calculating the time-dependent G values and product yields formed in a fast electron track. The calculations are based on an efficient stochastic simulation technique–the independent reaction times (IRT) method–which has previously been developed and validated in detail. The IRT method combines the reactants in pairs and selects reaction times randomly from the appropriate marginal reaction time distributions. Reactions are counted sequentially, starting with the shortest reaction time and limiting subsequent consideration to pairs in the set of remaining particles. The technique is efficient and accurate and is capable of dealing with ionic species, partially diffusion-controlled reactions, and reactive products. Our previous calculations based on the IRT method have considered only reactions of small numbers of particles in isolated spurs. A new simulation protocol is presented that efficiently handles the extended distribution and the large number of reactive particles encountered in a radiation track while making use of any isolation that exists on appropriate timescales. The simulated G values at zero time and 0.1 μs for a model 22-MeV electron track differ significantly from experimental values, and the discrepancy is ascribed to deficiencies in the initial distribution.

44950 Structure of electron tracks in water. 1. Distribution of energy deposition events. Pimblott, S.M. (Univ. of Notre Dame, IN (USA)); LaVerne, J.A.; Mozumder, A.; Green, N.J.B. *Journal of Physical Chemistry (USA),* 94(1): 488-495 (11 Jan 1990).

The distributions of energy deposition events for electrons in gaseous and liquid water and in amorphous ice have been calculated. These calculations make use of an inelastic cross section that takes into account binding energy, exchange, and relativistic effects and that is based on experimentally determined dipole oscillator strength distributions. The most probable energy loss in a single event by a 1-MeV electron is 22.5 eV in the condensed phases and 13.5 eV in the gaseous phase, while the average energy loss is 34, 38, and 40 eV/event for gaseous and liquid water and amorphous ice, respectively. Very little dependence of the distributions on incident electron energy is found. At 1 MeV the differential or single event distribution is found to be the same as the integral or cumulative distribution. The fractions of the total energy lost in events that are less than 100 eV are 0.76, 0.75, and 0.69 for gaseous and liquid water and amorphous ice, respectively.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 43919, 44636, 44881, 45549, 45899, 45910, 45911, 45912, 45913, 45914, 45915, 45916, 45917, 45918, 45919, 45920, 45921, 45922, 45923, 45924, 45925, 45926, 45927, 45928, 45929, 45930, 45931, 45932

44951 (CONF-9007142–1) **Design, synthesis and tumor specificity of azomycin ribo- and acyclonucleosides.** Srivastava, P.C. (Oak Ridge National Lab., TN (USA)); Hasan, A.; Buchsbaum, D.J. Oak Ridge National Lab., TN (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 9. international round table conference on nucleosides and nucleotides, and their biological applications; Uppsala (Sweden); 30 Jul 1990. Order Number DE90015169. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Synthesis, structure elucidation, and in vivo tumor specificity of nitroimidazole ribo- and acyclonucleosides are described. 11 refs.

44952 (JAERI-M–90-018) **A mathematical model for chemical reactions with actinide elements in the aqueous nitric acid solution: REACT.** Tachimori, Shoichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. 90p. (In Japanese). Order Number DE90513709. Source: NTIS (US Sales Only), PC A05/MF A01.

A mathematical model of chemical reactions with actinide elements: REACT code, was developed to simulate change of valency states of U, Pu and Np in the aqueous nitric acid solution. Twenty seven rate equations for the redox reactions involving some reductants, disproportionation reactions, and radiolytic growth and decay reaction of nitrous acid were programmed in the code . Eight numerical solution methods such as Porsing method to solve the rate equations were incorporated parallel as options depending on the characteristics of the reaction systems. The present report gives a description of the REACT code, e.g., chemical reactions and their rate equations, numerical solution methods, and some examples of the calculation results. A manual and a source file of the program was attached to the appendix. (author).

44953 Attained energy densities and direct photon emission in nucleus-nucleus collisions at 200 GeV/nucleon. Plasil, F. (Oak Ridge National Laboratory, TN (USA)). pp. 32, Paper NUCL 112 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC05-84OR21400. (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

Results from the CERN experiment WA80 will be presented, with emphasis on energy densities attained in central collisions and on the observation of direct photons. Energy densities are deduced from calorimetric measurements under certain assumptions and have a direct bearing on the probability that the deconfined quark-gluon plasma state has been created. If the formation of this state of matter has been achieved, a promising way to study its properties is by means of probes, such as electromagnetic probes, that are sensitive primarily to the initial states of the reaction, and do not reflect the characteristics of subsequent hadronization. Direct photons, arising mainly from Compton scattering of quarks and gluons and from quark-antiquark annihilation, are studied by the WA80 collaboration. Preliminary results from nucleus-nucleus collisions will be presented and compared with results from proton-induced reactions.

44954 Plutonium(IV) polymers in aqueous and organic media. Thiyagarajan, P. (Argonne National Lab., IL (USA)); Diamond, H.; Soderholm, L.; Horwitz, E.P.; Toth, L.M.; Felker, L.K. *Inorganic Chemistry (USA)*, 29(10): 1902-1907 (16 May 1990). DOE Contract W-31-109-ENG-38.

The structures of Pu(IV) hydrous polymers were measured by small-angle neutron scattering (SANS) in aqueous media and after solvent extraction in organic phases. The scattering data from polymers occurring as aqueous colloidal suspensions indicate long, thin, rodlike particles. Pu(IV) hydrous polymers formed in the presence of uranium were shorter than those produced in the absence of uranium; this is consistent with earlier observations that uranium reduces the rate of Pu(IV) polymer formation. The Pu(IV) polymers were extracted into C_6D_6 solutions by alkyl esters of phosphoric acid. The extractant-Pu polymer geometries were shorter than those in the aqueous media; their radii were increased by the lengths of the extended alkyl substituents of the extracts. Comparable extractions of Pu(IV) monomers were also examined. X-ray scattering measurements exhibit well-defined Bragg diffraction lines for the Pu polymer in both the aqueous and organic phases. All of the lines could be identified with those of PuO_2. Spectrophotometric measurements monitored the polymeric nature of the aqueous and organic suspensions. 26 refs., 5 figs., 2 tabs.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 43762, 44085, 44613, 44815, 44916

44955 (AD-A–221102/7/XAB) **Two-dimensional modeling of flame propagation in fuel-stream arrangements.** Rangel, R.H.; Sirignano, W.A. California Univ., Irvine, CA (USA). 1988. 25p. Source: NTIS, PC A03/MF A01.

Pub. in Dynamics of Reactive Systems. Part 2. Heterogeneous Combustion and Applications, Vol. 113, 128-150(1988).

In an effort to provide a useful simplified model of flame initiation and propagation in a spray arrangement consisting of several droplet streams injected in a gas flow, this work analyzes a two-dimensional heterogeneous flow between parallel walls in which the droplet streams are represented by parallel droplet sheets of specified inlet droplet number density and velocity. Thermal expansion of the gas flow is partly considered by allowing for the streamwise acceleration of the gas as the heat released by the chemical reaction increases the gas-phase temperature. The results indicate that ignition is dependent on local conditions only, although the overall efficiency of the reaction process may be a function of the general geometry of the system. A number of distinct reaction zones are shown to exist in different parts of the flowfield, indicating that the assumption of a unique flame front propagating throughout the mixture may be too simplistic. Premixed-type flames and diffusion-type flames are generally observed and various levels of interaction between them are possible.

44956 (PB–90-226168/XAB) **Soot formation: A review (edition with figures and tables).** Serageldin, M.A. Serageldin (Mohamed A.), Winston-Salem, NC (USA). Mar 1989. 188p. Source: NTIS, PC A09/MF A01.

The review on soot is mainly based on the information retrieved from Chemical Abstracts for the period 1981-1987 and technical meetings in 1988. It is a sequel to a previous one completed in 1981. Work related to a number of points, some of which have not yet been resolved satisfactorily, will be discussed. They include: relative importance of fuel composition to flame temperature; chemical species that are important for the growth of hydrocarbons; nature of the soot nucleus (ionic or radical); soot surface growth; and effect of additives (gases, halogenated materials and metal compounds).

44957 (PB–90-233792/XAB) **Basic research model of gas combustion in turbulent flow. Annual report, 1 June 1988-30 June 1989.** Dahm, W.J.A.; Tryggvason, G.; Krasny, R. Michigan Univ., Ann Arbor, MI (USA). 1989. 86p. Source: NTIS, PC A05/MF A01.

The report describes the development currently underway of a basic research model for gas combustion in turbulent flow. The model being developed is fundamentally different from the conventional types of turbulence models currently in use for flame calculations, both in terms of the underlying physical approximations made and in the numerical techniques used to implement them. The present approach is based on the idea that many of the precise and detailed fine scale processes at work in turbulent combustion have a simple self-similar structure, and as a result do not need to be continually recomputed in full detail. These can be modeled using results from recent experimental research into the fine scales of turbulent flows. Results obtained to date from this model have been carefully compared with finite difference simulations of the full governing equations for several simple test cases, and show that even complex and highly nonlinear phenomena such as local extinction of reactions in the flow field are correctly reproduced by the model. The model directly incorporates the strong coupling between the fluid dynamics and combustion chemistry in the flame. Work presently underway is incorporating volume source effects into the model.

44958 (SAND–90-1383C) **Ray traced scalar fields with shaded polygonal output.** Meyers, R.J. (Sandia National Labs., Albuquerque, NM (USA)); Stephenson, M.B. Sandia National Labs., Albuquerque, NM (USA). [1990]. 14p. Sponsored by National Science Foundation. DOE Contract AC04-76DP00789. Agreement No. CDR8522618. (CONF-901089–1: Visualization '90, San Francisco, CA (USA), 23-26 Oct 1990). Order Number DE90011023. Source: NTIS, PC A03/MF A01 - OSTI.

An algorithm is presented or rendering scalar field data which reduces rendering times by as much as two orders of magnitude over traditional full resolution image. Less than full resolution sampling of the scalar field is performed using a fast ray tracing method. The sampling grid points are output as a set of screen based gouraud shaded polygons which are rendered in hardware by a graphics workstation. A gradient based variable resolution algorithm is presented which further improves rendering speed. Several examples are presented. 16 refs., 8 figs., 2 tabs.

44959 Doppler-free two-photon-excited fluorescence spectroscopy of atomic hydrogen in flames. Goldsmith, J.E.M. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94551 (USA)); Rahn, L.A. *Optics Letters (USA)*, 15(14): 814-816 (15 Jul 1990).

We describe Doppler-free 205-nm two-photon excitation studies of atomic hydrogen performed using a single-mode pulsed dye-laser system in low-pressure flames. Excitation spectra confirm calculated line-strength ratios for transitions to the 3*S* and 3*D* states. Collisional broadening rates are obtained in several flames and compared with quenching rates measured in the same flames, using time-resolved fluorescence measurements.

44960 Multiphoton spectroscopy of Rydberg states of tetrachloroethylene. Williams, B.A. (School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14853 (USA)); Cool, T.A.; Rohlfing, C.M. *Journal of Chemical Physics (USA)*, 93(3): 1521-1532 (1 Aug 1990).

Spectroscopic studies of two-photon resonant vibronic bands of the (π,*np*) and (π,*nf*) Rydberg series of jet-cooled C_2Cl_4 are reported. Polarization ratio measurements for each transition and comparisons of experimental and calculated chlorine isotope shifts permitted the unambiguous assignment of vibronic band structure. *Ab initio* self-consistent field calculations of the harmonic frequencies for the optimized ground state geometry of C_2Cl_4 were performed for each of the seven isotopic chlorine compositions to assist interpretation of the isotope shift measurements. The 4*p*-Rydberg bands are quite weak and strongly perturbed, suggestive of localized Rydberg–valence state configuration mixing. The *nf*-Rydberg series provides a measurement of the first ionization potential for C_2Cl_4 of 75 216±5 cm^{-1} in good agreement with previous measurements. Mass analysis of ion fragmentation patterns reveals a multiphoton ladder switching excitation mechanism.

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44961 (UCRL-ID–103495-89) **Technical Abstracts: Mechanical engineering.** Bruner, J. (ed.). Lawrence Livermore National Lab., CA (USA). [1989]. 60p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90014797. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document is a compilation of the published, unclassified abstracts produced by mechanical engineers at Lawrence Livermore National Laboratory (LLNL) during the calendar year 1989. Many abstracts summarize work completed and published in report form. These are UCRL-90,000 and 100,000 series documents, which include the full text of articles to be published in journals and of papers to be presented at meetings, and UCID reports, which are informal documents. Not all UCIDs contain abstracts: short summaries were generated when abstracts were not included. Technical abstracts also provides descriptions of those documents assigned to the MISC (miscellaneous) category. These are generally veiwgraphs or photographs presented at meetings.

4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 43909, 43921, 43927, 43928, 44014, 44289, 44622, 44631, 44982, 44993, 45203, 45205, 46043, 46055, 46299, 46311

44962 (AD-A–221033/4/XAB) **Failure mechanism of urethane-elastomer-coated fabric collapsible fuel tanks. Technical report.** Feuer, H.O.; Touchet, P. Army Belvoir Research Development and Engineering Center, Fort Belvoir, VA (USA). Materials Fuels and Lubricants Lab. Mar 1990. 46p. (BRDEC–2488). Source: NTIS, PC A03/MF A01.

This report investigates the failure mechanism of urethane elastomer coated fabric collapsible fuel storage tanks. Past work has dealt with fuel degradation causing the tanks to fail but that work has met with failure. The mechanism that causes these tanks to fail is an extraction process whereby the protective ingredients in the polymer coating are removed by the fuel causing the elastomer to degrade by hydrolysis.

44963 (CEA-CONF–10022) **A review of information on flow equations for the assessment of leaks in radioactive transport containers.** Vallepin, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. d'Etudes Mecaniques et Thermiques); Higson, J.; Kowalewsky, H. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1989. 9p. (CONF-890631–: PATRAM '89: international symposium on the packaging and transportation of radioactive materials, Washington, DC (USA), 11-16 Jun 1989). Order Number DE90514640. Source: NTIS (US Sales Only), PC A02/MF A01.

Packages designed for the transport of radioactive materials are required by International and National regulations to restrict the possible loss of radioactive contents to very low levels under both Normal and Accident Conditions of Transport. The applicability of the equations used in the calculation of leak geometry and flow rates is assessed. Molecular, Laminar, Turbulent, and Choked flow may occur depending upon the leak geometry and pressure conditions. We present data from experimental work which used the flow models and equations to predict leakage rates through capillaries and gaps. National technical guides and computer codes for leak testing have been produced which give practical assistance in carrying out leak testing. The relationship between leak geometry and gas leakage rates can be described most appropriately and conservatively by the Knudsen flow equation for capillaries and in a slightly modified form for gaps.

44964 (DOE/NE/37969–T1) **DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990.** Michigan Univ., Ann Arbor, MI (USA); Florida Univ., Gainesville, FL (USA). Dept. of Nuclear Engineering Sciences; Oak Ridge National Lab., TN (USA); Texas Univ., Austin, TX (USA); Tennessee Univ., Knoxville, TN (USA). Jun 1990. 33p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FG02-86NE37969 ;FG02-86NE37967 ;AC05-84OR21400 ;FG Order Number DE90015777. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document provides a summary report, as well as the bimonthly reports (June–July 1990) by the four university groups and Oak Ridge National Laboratory, which discuss activities during the reporting period. This program provides for collaboration among teams at the University of Florida, Michigan, Tennessee, and Texas, and the Oak Ridge National Laboratory (ORNL) in the development of robotics for advanced nuclear power stations.

44965 (EGG-ESQ–8888) **Summary report for the tank tightness testing of underground storage tanks, Idaho National Engineering Laboratory.** EG and G Idaho, Inc., Idaho Falls, ID (USA). Mar 1990. 226p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015820. Source: NTIS, PC A11/MF A01 - OSTI.

Between August 14, 1989, and August 26, 1989, 16 underground storage tanks were tank tightness tested for leaks as part of the Idaho National Engineering Laboratory tank management program. This report summarizes the results of these tank tightness tests, the modifications and repairs made to the tank systems, fuel transfer records, and any problems that affected the

tank testing schedule. Of the 16 underground storage tanks tested, five failed the tank tightness test. Attempts were made to repair the tanks that failed the tank tightness test. Of those tanks, two were tested three times (one passed and one failed), and three were tested twice (two passed and one failed). The five failed tanks were removed and will be replaced with tanks that meet the Environmental Protection Agency regulations of underground storage tanks. 3 refs., 1 fig., 3 tabs.

44966 (EGG-ME-9068) **DU containment fixture high speed door test report.** Shapiro, C. EG and G Idaho, Inc., Idaho Falls, ID (USA). 25 May 1990. 26p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015471. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The high speed door is an assembly used with the DU Containment Fixture, to contain explosive by-products during testing at the Aberdeen Proving Grounds. Testing of the high speed door at the Idaho National Engineering Laboratory (INEL) was performed to verify closure times which comply with the design requirements. The tests were also designed to prove the structural integrity of the high speed door assembly, as well as its operational reliability. The success criteria for this testing was to perform ten consecutive closure tests which meet the closure time requirement, without permanently damaging the high speed door. The closure time requirement is 56 msec, as specified in the DU Containment Fixture Final Design Report, engineering design file 8.7. The high speed door assembly used in the tests is the actual assembly which will be delivered to the Aberdeen Proving Grounds as part of the AATCF project. 14 figs., 5 tabs.

44967 (JAERI-M-90-059) **Mock-up apparatus for preparation of plutonium fuel solution for criticality experiments at NUCEF.** Sakurai, Satoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Ami, Norio; Hirata, Masaru. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 39p. (In Japanese). Order Number DE90513801. Source: NTIS (US Sales Only), PC A03/MF A01.

The mock-up test program for dissolution of plutonium dioxide was planned to determine the preparation method of plutonium nitrate solution for criticality experiments at the Nuclear Fuel Cycle Safety Engineering Research Facility (NUCEF). The program consists of dissolution of plutonium dioxide by electrolytic oxidation method, valence adjustment and extractive purification of plutonium from ^{241}Am and silver. This report describes the design conditions, specifications and performance of the experimental apparatus and the glove box. (author).

44968 (JAERI-M-90-060) **A study on intelligent nuclear system (HASP: human acts simulation program): Progress report 1989.** Asai, Kiyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Fujii, Minoru; Uenaka, Junji; Kambayashi, Shaw; Higuchi, Kenji; Kume, Etsuo; Ohtani, Takayuki; Akimoto, Masayuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 106p. (In Japanese). Order Number DE90513802. Source: NTIS (US Sales Only), PC A06/MF A01.

The third year progress of the Human Acts Simulation Program, HASP in short, has been presented in this report. The HASP started in 1987 at JAERI as a ten-year research and development program of underlying technologies for intelligent robots, intelligent nuclear plants and so on. It consists of the research and development of technologies of a knowledge-base system, robot vision, robot kinematics/kinetics, plant geometry database, dose evaluation and high speed Monte Carlo machine. (author).

44969 (ORNL/FTR-3690) **[Robots, systems, and flexible automation]: Foreign trip report, July 2, 1990--July 21, 1990.** Beckerman, M. Oak Ridge National Lab., TN (USA). 6 Aug 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90015802. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended three conferences. The first of these was the IEEE International Workshop on Intelligent Robots and Systems 1990, held in Tsuchiura, Japan. The traveler presented a paper entitled "Multi-Criteria Position and Configuration Optimization for Redundant Platform/Manipulator Systems" on the behalf of the authors F. G. Pin and J. C. Culioli. The traveler chaired the session on Mobile Robot Control. The second conference attended was the 1990 Japan-USA Symposium on Flexible Automation, sponsored by the Institute of Systems, Control and Information Engineers (ISCIE) and the American Society of Mechanical Engineers (ASME). The traveler presented a paper entitled "Ultrasound and Visual Sensor Feedback and Fusion," authored by M. Beckerman, D. L. Barnett and S. M. Killough.

44970 (PTB-SE-25, pp. 133-150) **Container for the final storage of radioactive waste. Procedure in testing the type of design.** Droste, B. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.)); Wieser, K.E. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212--: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

The proposed process of testing the type of design of waste containers or waste casks for the final storage of radioactive waste in the Konrad mine is described. The testing of the design includes the assessment of the design safety of the waste containers or waste casks, particularly with regard to the safe enclosure of the waste products, by analytical and by experimental design tests and the assessment and determination of the specifications and quality assurance measures to be observed in the manufacture and use of waste containers manufactured by massproduction according to the tested type of design. (orig./DG).

44971 (PTB-SE-25, pp. 151-166) **Container for the final storage of radioactive waste. Design test and quality assurance measures.** Wieser, K.E. (Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.)); Droste, B. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Sep 1989. (In German). (CONF-8907212--: 85. PTB seminar on product control of radioactive waste, Braunschweig (Germany, F.R.), 17-18 Jul 1989). In *Product control of radioactive waste. Proceedings.* Order Number DE90517337. Source: NTIS (US Sales Only), PC A16/MF A01.

Compliance with the proposed regulations for quality assurance measures (QM) should ensure that only those samples are produced and used, which agree in their safety-related properties with the type of container construction tested with a favourable result and which therefore fulfil the requirements (here the PTB final storage conditions). The applicant is responsible for applying the QM's. The QM's introduced here for final storage containers, like the procedure for design tests, are derived from comparable regulations for other packing of dangerous goods (particularly for the transport of radioactive materials). (orig./DG).

44972 (SAND-89-3100C) **A Target Cueing and Tracking System (TCATS) for smart video processing.** Horton, R.D. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901092--3: Carnahan conference on security technology, Lexington, KY (USA), 10 Oct 1990). Order Number DE90015141. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A 'smart' system that uses state-of-the-art image processing techniques to detect and track targets moving in video or infrared imagery is of great value to a variety of applications ranging from fixed site security installations to military reconnaissance. The general purpose Target Cueing And Tracking System (TCATS) was developed to be independent of the application and the user interface. TCATS has successfully demonstrated a high detection capability and the ability to ignore exterior environmental conditions, such as cloud shadows moving through the scene, snow, blowing dust, rain, and moderate camera motion. TCATS can handle many targets and retain the identify of each object from one frame to the next. Special ruggedized hardware has been developed to reduce the size, cost, and power consumption, and to increase the processing rate, reliability, and environmental operating capability of the TCATS. TCATS can be incorporated into an existing video assessment system, without a major cost outlay for

construction. TCATS is undetectable to an outside intruder. The nature of TCATS would make it difficult for an intruder to defeat, even if the intruder were aware of its existence. Field evaluations are underway specifically for exterior fixed site security applications. This paper describes the TCATS algorithms, custom developed hardware, and preliminary field test results. 5 refs., 7 figs.

44973 (SAND–90-0776) **Mechanical property mapping of the ductile cast iron MOSAIK KfK cask.** Salzbrenner, R.; Crenshaw, T.B. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 39p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90014854. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The mechanical properties of a coring from the bottom of the MOSAIK KfK cask were determined as a function of through wall position for the 21 cm thick section. The elastic moduli were determined from ultrasonic velocity measurements. The standard tensile properties were determined as a function of strain rate at −29°C. The Charpy impact behavior was measured as a function of temperature from −100 to +100°C. The fracture toughness was determined for both static and elevated loading rates (at −29°C). In addition to these mechanical properties, the variation in microstructure and composition with position in the coring is reported. The mechanical properties provide the essential information for the stress analysis modeling of the behavior of the cask during a drop test which will be conducted to simulate a very severe accident condition. The results from the elevated loading rate fracture toughness tests are used to suggest the severity of the flaws that should be introduced into the cask for the sequential series of drops which are scheduled to begin in March 1990. 24 refs., 16 figs., 6 tabs.

44974 (SAND–90-1680) **Statistical characterization of a mode-stirred chamber.** Kostas, J.G.; Boverie, B. Sandia National Labs., Albuquerque, NM (USA). Jun 1990. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE90014860. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report describes a statistical model for field amplitudes within a mode-stirred chamber. The parameters of the probability density function for field amplitudes are estimated by means of maximum likelihood. The accuracy of these parameters is specified as a function of the amount of data used. An experimental investigation of the possibility of using an existing electromagnetic shield room as a mode-stirred chamber is described. The physical alterations of the chamber and the instrumentation are summarized. Descriptions of the tests results are reported. The tests were conducted to determine: the unloaded and loaded Q of the chamber, descriptive statistics of the electromagnetic fields, correlation distances of the fields in frequency, tuner angle, and spatial position, and the possibility of using frequency stirring as an alternative to mechanical stirring. 10 refs., 20 figs., 10 tabs.

44975 (SAND–90-1955) **Oxygen Deficiency Monitor System.** Devlin, G.L. (Ktech Corp., Albuquerque, NM (USA)). Sandia National Labs., Albuquerque, NM (USA). 12 May 1990. 24p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC04-76DP00789. Order Number DE90014866. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the components and installation of the Oxygen Deficiency Monitor System (ODMS) at the Simulation Technology Laboratory (STL) at Sandia National Laboratories. The ODMS presently monitors the oxygen concentration of the ambient air in the lower levels of the laboratory where air circulation may be insufficient to disperse gases that may settle and accumulate creating an oxygen-deficient environment. The intent of this report is to provide a general introduction to the system for personnel involved in the maintenance and modifications of the system and may be useful to people interested in installing a similar system. This will report describe the hardware components, installation considerations, operation, and maintenance of the system. 6 refs., 5 figs.

44976 (SAND–90-2129C) **Volumetric light source theory.** Walko, R.J.; Ashley, C.S.; Brinker, C.J.; Reed, S.T. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009201–2: Radioluminescent technology conference, Annapolis, MD (USA), 25-26 Sep 1990). Order Number DE90015566. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In light sources such as tungsten filament bulbs, fluorescent tubes and gas tube type radioluminescent (RL) lamps, visible light is emitted from a thin surface layer of excited material. In contrast, neon bulbs, xenon flash tubes and lasers emit light generated throughout their volumes. The first group can be characterized as surface emitters and the latter as volumetric emitters. Theoretically, an ideal volumetric light source has definite advantages over a surface source. In reality, practical volumetric sources will have limitations as well. These advantages and limitations will be discussed with particular emphasis on comparisons between current gas tube type RL lamps and the more advanced volumetric RL lamps.

44977 (UCRL-ID–104341) **Using the x-ray region of the electromagnetic spectrum for alignment: Overview, geometric optics and design considerations.** Addis, R.B. Lawrence Livermore National Lab., CA (USA). 30 May 1990. 40p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90014798. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Traditional alignment systems based on the use of visible light are not practical when opaque materials obstruct the alignment axis. X-ray Alignment Systems (XRA) have been designed specifically to overcome this limitation. XRA systems are analogous to visible light alignment methods, in that they both consist of placing an object to be aligned between a source of radiation and a detector. This report summarizes the interaction of the components which comprise an XRA System. Using physical principles and the knowledge developed by the traditional x-ray fields, general design guidelines are established. The specialized requirements for these systems are also provided, with analytical relationships for the basic alignment configurations being derived. These equations are used to predict the alignment error of a proposed system, in addition to interpreting the resulting alignment images. While this report establishes the limitations of this technique, it also reveals that XRA has some substantial advantages over optical methods. Besides the ability to penetrate materials opaque to visible light, it is possible to eliminate all optical aberrations when using a polychromatic x-ray source. This results in true geometric optics, making the measurements highly repeatable and accurate. This technique can readily position a fiducial within 0.001 in. of the alignment axis using off-the-shelf components. Typical alignment geometries are defined with an accuracy of one microradian through a distance of 100 feet. The ability of these systems to monitor the alignment in near real-time when using an x-ray camera is another advantage. This allows active alignment to be performed from a remote location prior to an experiment or through its duration. 19 refs., 17 figs., 5 tabs.

44978 (UCRL-JC–104204) **CVMAC 2D Program: A method of converting 3D to 2D.** Lown, J. Lawrence Livermore National Lab., CA (USA). 20 Jun 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009225–1: 12. annual international computervision user conference, Nashville, TN (USA), 30 Sep - 3 oct 1990). Order Number DE90015147. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents the user with a method of converting a three- dimensional wire frame model into a technical illustration, detail, or assembly drawing. By using the 2D Program, entities can be mapped from three-dimensional model space into two-dimensional model space, as if they are being traced. Selected entities to be mapped can include circles, arcs, lines, and points. This program prompts the user to digitize the view to be mapped, specify the layers in which the new two-dimensional entities will reside, and select the entities, either by digitizing or windowing. The new two-dimensional entities are displayed in a small view which the program creates in the lower left corner of the drawing. 9 figs.

44979 (UCRL-JC–104362) **The measurement and finite element analysis of the dynamic stiffness of non-uniform clearance, gas, thrust bearings.** Holster, P. (Philips Research Labs., Eindhoven (Netherlands)); Jacobs, J.; Roblee, J. Lawrence Livermore National Lab., CA (USA). Jun 1990. 29p. DOE Contract

W-7405-ENG-48. (CONF-901071–6: Joint STLE-ASME tribology conference, Toronto (Canada), 7-10 Oct 1990). Order Number DE90015120. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents an overview of a finite-element-method (FEM) approach for the calculation of the dynamic stiffness of circular, externally-pressurized, gas, thrust bearings with a non-uniform clearance. Some observations are made about the characteristic behavior of gas bearings subject to dynamic loading. The primary emphasis of this paper, however, is the development and qualification of a test apparatus and the necessary test techniques for measuring dynamic stiffness up to 250 N/μm at frequencies up to 2000 Hz. A complete, experimental verification of the FEM model will be presented in a later paper. 10 refs., 9 figs., 2 tabs.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 44001, 44085, 44104, 45758, 45759, 46258, 46312

44980 (ANL–90/19) **Two-phase flow patterns and frictional pressure gradients in a small, horizontal, rectangular channel.** Wambsganss, M.W. (Argonne National Lab., IL (USA)); Jendrzejczyk, J.A.; France, D.M.; Obot, N.T. Argonne National Lab., IL (USA). May 1990. 112p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE90014802. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Two-phase flow patterns and frictional pressure gradients in flow in small, rectangular channels are being studies as part of a larger research program addressing phase-change heat transfer of pure refrigerants and refrigerant mixtures in plate-fin heat exchangers. Small rectangular flow channels were selected as representative of plain fin geometries. The particular channel reported herein has dimensions of 19.05 x 3.18 mm. Adiabatic flows of air/water mixtures, with the flow channel horizontal and the channel exit at near-atmospheric conditions, were utilized in the experiments. Analysis and interpretation of the pressure data relative to observed flow pattern transitions led to an objective method for determining the plug/bubble-to-slug flow transition. This method, together with visual observations, supplemented with photographic data, was used to develop a flow pattern man. A comparison of existing flow pattern maps for circular pipes, capillary tubes, and larger rectangular channels led to the conclusion that, while qualitative agreement exists, these maps are not generally applicable on a quantitative basis to the subject small rectangular channel. Two state-of-the-art correlations for frictional pressure gradient were evaluated, with particular emphasis on the practically important ranges of total mass quality and mass flux, from the standpoint of plate-fin heat exchangers designed as evaporators. Neither correlation was in good agreement over the entire range of interest. A modified, semiempirical correlation was developed to predict, with satisfactory accuracy for design purposes, the measured data of these experiments. 60 refs., 44 figs., 2 tabs.

44981 (JAERI-M–90-057) **Automated finder for the critical condition on the linear stability of fluid motions.** Fujimura, Kaoru (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 31p. Order Number DE90513761. Source: NTIS (US Sales Only), PC A03/MF A01.

An automated finder routine for the critical condition on the linear stability of fluid motions is proposed. The Newton-Raphson method was utilized for an iteration to solve nonlinear eigenvalue problems appeared in the analysis. The routine was applied to linear stability problem of a free convection between vertical parallel plates with different non-uniform temperatures as well as a plane Poiseuille flow. An efficiency of the finder routine is demonstrated for several parameter sets, numerically. (author).

44982 (SAND–90-0086C) **Design and verification of nearly ideal flow and heat transfer in a rotating disk CVD reactor.** Breiland, W.G. (Sandia National Labs., Albuquerque, NM (USA)); Evans, G.H. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-901088–2: 11. international conference on chemical vapor deposition, Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90012922. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A research CVD reactor design is presented for a rotating disk configuration. The reactor can be operated under conditions such that ideal, finite-radius disk behavior is achieved over most of the disk surface. Boundary conditions, flow stability under both isothermal and heated-disk conditions, and gas-phase temperatures are addressed with both one- and two-dimensional numerical fluid mechanics models. Experimental verification of the design using flow visualization and laser Raman thermometry are presented. 15 refs., 4 figs.

44983 **Stationary flows from a model Boltzmann equation.** Azmy, Y.Y. (Southern California Univ., Los Angeles, CA (USA)); Protopopescu, V. pp. 15-28 of Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

A one-dimensional Boltzmann equation model is generalized by allowing the collision frequency to be an arbitrary positive function and by including more general boundary conditions allowing for both diffuse and specular reflections at the wall. For a simpler variant of the model, the thermal conductivity and the density as a function of temperature for this model are analyzed and compared to available experimental data in order to assess better the model's plausibility. Emphasis is placed on comparison of the experimentally determined values to the theoretically calculated values of the reduced mass density and thermal conductivity as a function of the reduced temperature for five liquid metals. 6 refs.

44984 **Neutralization of a 50-MeV H(-) beam using the ring nozzle.** Youssef, N.S. (Southern California Univ., Los Angeles, CA (USA)); Brook, J.W. pp. 241-253 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Measurements are presented of the radial distribution of the neutral particles produced during the passage of a 50-MeV H(-) ion beam through the gas flowfield created by pulsed operation of a ring nozzle. Both argon and xenon were used as the neutralizing medium. The experiment was optimized so that the peak neutral fraction was obtained on the ring centerline. The peak neutral fractions observed are in agreement with theoretical predictions. Optimum conditions required about 30 percent of the mass flow using xenon as was required using argon. The line integrals inferred from the neutral fraction distributions are in qualitative agreement with the gasdynamic measurements of Farnham and Muntz (1988). 6 refs.

44985 **Experimental investigation of rarefied flow through tubes of various surface properties.** Curtis, J. pp. 273-282 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Measurements have been made of the helium conductance of tubes of stainless steel, tantalum, and molybdenum, both before and after heating to high temperature. The measurements were made in an all-metal vacuum system capable of pressures in the range 10 to the -9th to 10 to the -10th torr. The conductance was calculated from the time rate of rise in pressure and a constant based on the volumes of system components. Measured conductance values obtained both before and after heating are presented for comparison with the diffuse values. The measured values after heating are substantially larger than the diffuse values, with those obtained for the molybdenum tube showing the larger increase. 13 refs.

44986 Radially directed underexpanded jet from a ring-shaped nozzle. Teshima, K. pp. 378-390 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

A radially directed underexpanded jet from a ring-shaped nozzle into a quiescent gas is studied experimentally by flow visualization using a laser-induced fluorescence technique and by density measurement using laser Rayleigh scattering. The radially expanded flow makes a core, which becomes a new source of the secondary jet. Since the gas molecules experience many more collisions before the final expansion than in a free-jet expansion, this type of jet will be useful as a molecular beam source.

44987 Studies of thermal accommodation and conduction in the transition regime. Thomas, L.B. (Southern California Univ., Los Angeles, CA (USA)); Krueger, C.L.; Loyalka, S.K. pp. 502-516 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Thermal conductivity measurements are reported for krypton and argon, taken in cells of cylindrical symmetry. The data were taken under extreme clean filament conditions so that the thermal accommodation coefficient remains constant over the full range of pressures, 0.005-20 torr. Both the accommodation coefficient and thermal conductivity are determined. The data are used to test a number of theoretical treatments of the complex problem of heat transfer in the transition regime of kinetic theory. 15 refs.

44988 Large rotational polarization observed in a Knudsen flow of H2-isotopes between LIF surfaces. Horne, R.; Hermans, L.J.F. pp. 517-529 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Molecular angular momentum polarization produced in gas-surface collisions is investigated by the magnetic field effect on a Knudsen flow between parallel surfaces in the temperature range of 78-695 K. The effect for H2 isotopes scattered by lithium fluoride LiF (001) crystal surfaces are found to be two to three orders of magnitude larger than previously observed for metal surfaces. This is attributed to the large corrugation of the LiF crystal face, since the polarization type involved is produced by in-plane forces. 21 refs.

44989 Internal state-dependent molecule-surface interaction investigated by surface light-induced drift. Hermans, L.J.F.; Spreeuw, R.J.C.; Van der Mee, G.J.; Hoogeveen, R.W.M. pp. 530-541 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Experimental results are reported on surface light-induced drift in a one-component gas. This effect originates from velocity-selective excitation followed by state-dependent molecule-surface interaction. The experiments are performed on gaseous CH_3F, rovibrationally excited by a narrow-band CO_2 laser tuned within the Doppler-broadened absorption profile. The accommodation coefficient for parallel momentum alpha is found to depend much more strongly on the rotational than on the vibrational state, the change in alpha on excitation being in the range of 0.001-0.01. The experimental results suggest that alpha increases stronger than linearly with the rotational quantum number. 15 refs.

4205 Materials Testing

Refer also to citation(s) 43759, 44131, 44205, 44515, 44626, 44979, 45219, 45917

44990 (CEA-R–5513) **Resolution enhancement for ultrasonic echographic technique in non destructive testing with an adaptive deconvolution method.** Vivet, L. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Paris-11 Univ., 91 - Orsay (France). 1989. 170p. (In French). Order Number DE90514564. Source: NTIS (US Sales Only), PC A08/MF A01.

The ultrasonic echographic technique has specific advantages which makes it essential in a lot of Non Destructive Testing (NDT) investigations. However, the high acoustic power necessary to propagate through highly attenuating media can only be transmitted by resonant transducers, which induces severe limitations of the resolution on the received echograms. This resolution may be improved with deconvolution methods. But one-dimensional deconvolution methods come up against problems in non destructive testing when the investigated medium is highly anisotropic and inhomogeneous (i.e. austenitic steel). Numerous deconvolution techniques are well documented in the NDT literature. But they often come from other application fields (biomedical engineering, geophysics) and we show they do not apply well to specific NDT problems: frequency-dependent attenuation and non-minimum phase of the emitted wavelet. We therefore introduce a new time-domain approach which takes into account the wavelet features. Our method solves the deconvolution problem as an estimation one and is performed in two steps: (i) A phase correction step which takes into account the phase of the wavelet and estimates a phase-corrected echogram. The phase of the wavelet is only due to the transducer and is assumed time-invariant during the propagation. (ii) A band equalization step which restores the spectral content of the ideal reflectivity. The two steps of the method are performed using fast Kalman filters which allow a significant reduction of the computational effort. Synthetic and actual results are given to prove that this is a good approach for resolution improvement in attenuating media.

44991 (CEGB-RD-B–6284/R89) **Laser vibrometer for tie bar vibration studies.** Forsey, R.C.; Watson, A.G. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Aug 1989. 12p. Order Number DE90636984. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An optical displacement transducer using pulsed laser light and a triangulation principle has been developed to measure the lateral vibration of Advanced Gas-cooled Reactor (AGR) fuel stringer tie bars in a laboratory pressurised flow rig. Three pairs of orthogonally mounted units provide positional data to a resolution of $< 10\mu m$ in the frequency range 0-600Hz. The system has further application to positional measurement in hostile environments such as remote welding in nuclear reactors. (author).

44992 (CONF-8905112–4) **The use of automated ball indentation testing to measure flow properties and estimate fracture toughness in metallic materials.** Haggag, F.M.; Nanstad, R.K.; Hutton, J.T.; Thomas, D.L.; Swain, R.L. Oak Ridge National Lab., TN (USA). [1989]. 45p. Sponsored by U.S. DOE Energy Research; Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From ASTM symposium on the applications of automation technology to fatigue and fracture testing; Kansas City, MO (USA); 22-23 May 1989. Order Number DE90015797. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A field indentation microprobe (FIM) apparatus was developed (and patented) to evaluate, nondestructively in situ, the integrity of metallic structures. This study investigated the applicability of using a new automated ball indentation (ABI) test, which is a major part of the FIM, to measure the flow properties of metallic materials including those exhibiting Lueders or inhomogeneous strains (carbon steels, titanium alloys, aluminum alloys, etc.) and to estimate their fracture toughness. The ABI test is based on multiple indentations (at the same penetration location) of a polished metallic surface by a spherical indenter. Automation of the test, where a computer and test controller were used in innovative ways to control the test as

well as to analyze test data, made it simple, rapid, accurate, economical, and reproducible. Results of ABI tests on different metals, welds, and irradiated materials are presented and discussed in this paper. Excellent agreement was obtained between ABI-derived data and those from standard ASTM uniaxial tensile and fracture toughness tests. 17 refs., 20 figs., 2 tabs.

44993 (ETDE-IT–90-34) **Fabrication of artificial reference defects for non destructive testings.** Bonavero, G. ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile. Apr 1989. 11p. (CONF-890478–2: 12. world conference on non-destructive testing, Amsterdam (Netherlands), 23-28 Apr 1989). Order Number DE90514510. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at 12th world conference on non destructive testing (Amsterdam, 23-28 Apr 1989).

Non-destructive testing techniques (for machinery components, pipes, etc.) require artificial reference defects for the calibration of instruments and electronic equipment in order to obtain very high quality controls. This problem is found in every industrial sector - chemistry, mechanics, metallurgy, aeronautics, etc. ENEA (Italian Commission for Alternative Energy Sources) in collaboration with CEE-EURATOM, has built a laboratory devoted to the production of artificial reference defects of very high quality. Special techniques are used that insure very high precision and fabrication reproducibility (about 200 defects per year). The applied techniques described in this paper are: microspark-erosion, micro-punching and micro-drilling.

44994 (PB–90-231192/XAB) **Development of a laboratory rutting-resistance testing method for asphalt mixes. Final report, January 1988-August 1989.** Lai, J.S. Georgia Inst. of Tech., Atlanta, GA (USA). School of Civil Engineering. Aug 1989. 97p. Source: NTIS, PC A05/MF A01.

A loaded wheel testing machine (LWT machine) was used successfully in the previous studies to evaluate the rutting characteristics of asphalt mixes. The objective of the study was to modify and improve the machine and the sample preparation method and to develop a testing procedure for using the machine. The improvements and modifications made to the LWT machine include the development of an environmental chamber attached to the machine for maintaining a constant elevated temperature for the test sample during the rutting test and the development of a preheating box for preconditioning the test sample to the prescribed elevated temperature. The temperature of the beam samples can be heated and maintained up to 125F at + or - 1F variation. Other modifications and improvements were made for the control and operation of the testing machine. Another major effort was to develop a beam sample preparation method by static compression using a universal testing machine.

4210 Combustion Systems

Refer also to citation(s) 43760, 43761, 44001, 44639

4220 Mining and Underground Engineering

Refer also to citation(s) 43850, 43851, 44111, 44113, 44116, 44118, 44119

44995 (TAC–CE02875) **Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.** Lo, K.Y.; Boyd, J.M.; Cooke, B.H.; Dullerud, P.E.; Dunbar, D.D.; Jenkins, G.F.; Lukajic, B.J.; Lee, C.F.; Palmer, J.H.L.; Yuen, C.M.K. (eds.). Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. 1068p. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This symposium on advanced tunnelling covers investigation and testing, design and construction, seepage control and lining, and case studies. Particular attention is paid to hydroelectric and pumped storage power plants, the underground storage of petroleum and petroleum products, ground water control, concretes and grouting, and the enhanced recovery of bitumen from oil sands. Separate abstracts have been prepared for 14 papers.

44996 (TAC–CE02875, pp. 487-494) **Large scale dewatering used in tunnelling for a pumped storage scheme.** Guzina, B.J. (Energoprojekt Consulting Engineers and Contractors, Blograd (Yugoslavia)); Obradovic, J. Tunnelling Association of Canada (Canada); National Research Council of Canada, Ottawa, ON (Canada). 1989. (CONF-890921–: International congress on progress and innovation in tunnelling, Toronto (Canada), 9-14 Sep 1989; CE–02875). In *Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2.* Source: Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN.

This paper deals with the serious problem of dewatering encountered at the underground works of a 2 by 150 MVA pumped storage scheme built recently in the Middle East. The problem was realized when the access tunnel to the power cavern entered the aquifer in highly jointed, fissured limestone and dolomitic rock. Tunnelling had to be stopped, due to the high water influx. Since 80% of the underground excavation was located within the aquifer, the solution was found in the complete depletion of the aquifer by pumping out. To provide for the progress of the work, pregrouting of the rock to be tunnelled was implemented in the access tunnel and in a part of the tail-race tunnel. The aquifer was depleted by 55 m by pumping out 55 million m^3 of water. This depletion enabled for the excavation of the power and transformer caverns and the concrete lining of all underground works to be carried out in practically dry conditions. Recommendations are made for similar situations. 3 refs., 5 figs.

4230 Marine Engineering

Refer also to citation(s) 44803

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 44158, 44195, 44632, 44679, 44713, 44727, 44788, 44851, 45082, 45106, 45181, 45182, 45183, 45184, 45187, 45195, 45199, 45219, 45221, 45225, 45232, 45466, 45661, 46070, 46088, 46219, 46220, 46243, 46284

44997 (AD-A–220898/1/XAB) **New discharge pumping method for CO_2 lasers. Report for 1 February-30 November 1989.** Jacob, J. Science Research Lab., Inc., Somerville, MA (USA). 31 Jan 1990. 68p. Source: NTIS, PC A04/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

A pulsed CO2 laser system has been designed, fabricated, and successfully tested. Laser pulses have been generated with measured output energy of 600 mJ, pulse length 40 microsecond, and conversion efficiency of 14% in a 3:2:1 (HeN2:CO2) gas mixture. The laser operates at a total gas pressure between 5 and 40 Torr, and utilizes the COLD-I all-solid-state CO2 laser driver developed by SRL. Typical current, voltage, and laser output traces are presented and compared to numerically simulated curves, showing reasonable agreement. The theoretical model of CO2 laser discharges has been extended and utilized to analyze the steady state solutions and stability criteria for three regimes of operation: the stiff voltage case, the stiff current case, and the finite external impedance case. Numerical solutions are presented for the temporal evolution of the electron (plasma) density, the metastable density, and the electric field under various conditions. The theory of RF discharge stabilization has been extended to two spatial dimensions, and numerical results are presented for the stiff current and the stiff voltage cases. In a repetitively pulse CO2 laser, the lasing gas must be cooled between pulses to preserve efficiency. Conduction cooling has been examined by SRL as an advanced alternative to the traditional flow loop approach. This concept minimizes the weight of the laser head. A thermal analysis of a pulsed CO2 laser head with conduction cooling is presented, along with a discussion of beam quality effects due to acoustic and thermal processes.

44998 (AD-A-221029/2/XAB) **Self-starting condition for additive-pulse mode-locked lasers.** Ippen, E.P.; Liu, L.Y.; Haus, H.A. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Electrical Engineering and Computer Science. 1 Feb 1990. 4p. Source: NTIS, PC A01/MF A01.

Pub. in Optics Letters, Vol. 15, No. 3, 183-185(1 Feb 1990).

This reprint analyzes self-starting in additive-pulse mode-locked lasers and find that dynamic gain saturation can play a determining role. A simple condition for self-starting is presented for comparison with experiments on different laser systems.

44999 (AD-A-221038/3/XAB) **Pump-source requirements for end-pumped lasers.** Fan, Y.T.; Sanchez-Rubio, A. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. Feb 1990. 8p. (JA-6324). Source: NTIS, PC A02/MF A01.

Pub. in. IEEE Journal of Quantum Electronics, Vol. 26, No. 2, 311-316(Feb 1990).

A simple model is developed to relate laser design and properties of a gain medium to the requirements on a pump source for end-pumped lasers or amplifiers. A novel technique for scaling the pump power or energy for end-pumped lasers is presented and analyzed in terms of this model. The results indicate that power or energy scaling of the pump source for end-pumped lasers is not limited by geometry; however, the results also show that some minimum pump energy or power is required.

45000 (AD-A-221075/5/XAB) **Relativistic klystron amplifiers driven by modulated intense relativistic electron beams. Memorandum report.** Lau, Y.Y.; Friedman, M.; Krall, J.; Serlin, V. Naval Research Lab., Washington, DC (USA). 11 Apr 1990. 76p. (NRL-MR-6627). Source: NTIS, PC A05/MF A01.

This paper, gives an overview of the novel relativistic klystron amplifiers which are driven by an annular intense relativistic electron beam (500 kV, 10 kA range) which is modulated by an external rf source (1.3 GHz, 100 kW range). Experiments, theory, simulation and simple models are presented to illustrate the unusual properties of such devices, which result from the intense space charge of the beam. Chief among them include electrostatic insulation against vacuum breakdown at high power levels, efficient current modulation, short bunching length, and amplitude and phase stability of the output signal. Many of these unexpected features were revealed in two separate experiments: one with the lower current beam (5 kA, 2 cm beam radius), and the other one with a higher current beam (16 kA, 6.6 cm beam radius). Three gigawatts or rf power at 1.3 GHz were generated with the large diameter beam at an efficiency of 35 percent with 37 dB gain. These experiments will be reviewed, along with a combination of particle simulation results and analytic models which facilitate the interpretation. Pay special attention to the unfamiliar features of these amplifiers, and shall address the critical issues which need to be solved before such amplifiers can fulfill their potential in a wide range of applications.

45001 (AD-A-221182/9/XAB) **Models of intracavity frequency-doubled lasers. Doctoral thesis.** James, G.E. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). 1990. 328p. (AFIT/CI/CIA-90-007D). Source: NTIS, PC A15/MF A02.

In many laser applications, the frequency of light produced by the laser is doubled by a crystal with nonlinear optical properties. The presence of such a crystal inside a laser cavity can produce large, irregular fluctuations in the output intensity. This thesis examines nonlinear systems of ordinary differential equations for the longitudinal mode intensities (physical observables) and gains of intracavity doubled lasers. A new system of equations is derived which models the frequency doubling of a general class-B laser with any number of intracavity birefringent elements, and the relevant features of the cavity configuration are reduced to two parameters. The complete range of behavior of the intensity output is characterized for one, two and three longitudinal modes in this general framework. A novel approach to the linearized stability analysis of the model leads to explicit stability criteria for the cavity parameters, and to several successful predictions of ways to stabilize the laser output. Several experimental laser configurations previously studied prove to be special cases of the general model; all the experimental results confirm the correspondence between the theory and experiment. In the specific case of an intracavity doubled Nd:YAG laser, numerical results trace an intermittency route to chaos, with cross saturation as the control parameter. Samples of experimental output are closely matched by numerical integrations. The intracavity doubled Nd:YAG laser is found, in theory and experiment, to be a rich source of nonlinear dynamics.

45002 (AD-A-221265/2/XAB) **Micro-fabrication compatible wiggler design scalable to sub-millimeter periods.** Jackson, R.H.; Bluem, H. Maryland Univ., College Park, MD (USA). 1989. 2p. Source: NTIS, PC A01/MF A01.

Pub. in the International conference on Infrared and Millimeter Waves Conference Digest (14th), SPIE, Vol. 1240, 423-424(1989).

A linear wiggler design has been developed which is compatible with micro-fabrication techniques and is capable of producing uniform, multi-kilogauss fields at millimeter and sub-millimeter periods. The wiggler configuration employes a 3D winding pattern which results in reduced field errors due to edge effects. A 3cm prototype has been constructed and tested, and a 1.5mm period wiggler is presently being fabricated. Measured performance of the prototype is compared to calculations based on the POISSON Group codes.

45003 (AD-A-221267/8/XAB) **Final design and cold tests of a harmonic ubitron amplifier.** Bluem, H.; Jackson, R.H.; Pershing, D.E.; Booske, J.H.; Granatstein, V.L. Maryland Univ., College Park, MD (USA). 1988. 11p. Source: NTIS, PC A03/MF A01.

A harmonic ubitron amplifier has been designed and is nearing final assembly. The experiment is intended to be a proof-of-principle study of the feasibility of harmonic operation of the ubitron. Harmonics are a key in reducing the high voltage requirements of ubitrons. The configuration of the experiment consists of a 250kV/100A electron gun, an input transition from single mode to overmoded waveguide, a linear wiggler, mode selective output couplers, and a calorimeter/water load. The design and goals of the overall experiment will be discussed along with the design and test results of individual components.

45004 (AD-A-221268/6/XAB) **Nonlinear theory and design of a harmonic ubitron/free-electron laser.** Freund, H.P.; Bluem, H.; Jackson, R.H. Maryland Univ., College Park, MD (USA). Dept. of Electrical Engineering. 1989. 7p. Source: NTIS, PC A02/MF A01.

Pub. in Nuclear Instruments and Methods in Physics Research, Vol. A285, 169-175(1989).

A fully three-dimensional nonlinear analysis of the harmonic Ubitron/Free Electron Laser is discussed which is valid for arbitrary harmonic number. The analysis has been performed for a configuration consisting of a beam propagating through a loss-free rectangular waveguide in the presence of a planar wiggler field. The wiggler model includes an adiabatic entry taper to model the injection of the beam into the wiggler, parabolic pole pieces to provide additional focussing in the plane normal to the wiggler, and an amplitude taper downstream from the entry region for efficiency enhancement. The advantage of harmonic operation is that relatively high operating frequencies may be obtained with relatively modest beam energies; however, this occurs at the expense of a greater sensitivity to beam thermal effects. In addition to enhancing the extraction efficiency, a tapered wiggler has been shown to reduce the sensitivity of the interaction to thermal effects. Thus, the tapered wiggler is designed to counter the increased thermal sensitivity of the harmonic interaction. Specific design criteria for a third harmonic experiment operating a 15 GHz with a 55keV electron beam are discussed.

45005 (AD-A-221300/7/XAB) **Development of elements of a high-Tc superconducting cable. Report for 1 January-31 March 1990.** Lay, K.W. General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center. 31 Mar 1990. 5p. Source: NTIS, PC A01/MF A01.

The goal of the program is the development of materials and processes for the fabrication of a composite high Tc superconductor element made of a superconducting coating in a supporting fiber.

45006 (AD-A-221418/7/XAB) **GaInAsP/InP buried-heterostructure surface-emitting diode laser with monolithic integrated bifocal microlens.** Liau, Z.L.; Walpole, J.N.; Missaggia, L.J.; Mull, D.E. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 26 Mar 1990. 4p. (JA-6405). Source: NTIS, PC A01/MF A01.

Pub. in Applied Physics Letters, Vol. 56, No. 13, 1219-1221(26 Mar 1990).

A new surface-emitting diode laser has been demonstrated, which consists of a buried-heterostructure waveguide gain region on one side of the substrate and a bifocal microlens of 210 microns diameter on the other side. The bifocal microlens is composed of a collimating lens in the center (70 microns diameter) and a spherical mirror in the surrounding region, for output collimation and optical feedback, respectively. Accurate alignment between the gain region and the microlens has been obtained by using the focused light spot produced by the latter. Initial device results show room-temperature pulsed threshold currents around 92 mA (with a low of 70 mA) and far-field patterns with a narrow central lobe of 1.25. Surface-emitting diode laser, Buried-heterostructure waveguide lasers, Bifocal microlens.

45007 (AD-A-221560/6/XAB) **Fabrication of microwave guides using high-Tc superconductors. Final report, 15 July 1989-14 January 1990.** Trivedi, S.B. Brimrose Corp. of America, Baltimore, MD (USA). 14 Jan 1990. 37p. Source: NTIS, PC A03/MF A01.

The objective of this study was to produce bulk high Tc superconductor $YBa_2Cu_3O_{7-x}$ with microwave conductivity at least as good or better than that of copper. The subsequent aim was to fabricate cylindrical wave guide using this material. The ultimate goal of this study is to produce $YBa_2Cu_3O_{7-x}$ with microwave conductivity exceedingly higher (at least two orders of magnitude better) than that of copper. In principle, this is possible if the microstructure of the superconductor material is carefully controlled. The above-stated goal could be easily achieved if the large single crystals of $YBa_2Cu_3O_{7-x}$ are available or if the inside surface of a suitable substrate material in the form of hollow cylinder, could be coated with the superconductor material of high quality. The former approach, currently, seems to be far from practical realization.

45008 (AD-A-221622/4/XAB) **Spontaneous emission in the waveguide free-electron laser. Technical report No. 59, 1 October 1985-30 December 1986.** Amir, A.; Boscolo, I.; Elias, L.R. California Univ., Santa Barbara, CA (USA). Quantum Inst. Nov 1985. 16p. Source: NTIS, PC A03/MF A01.

Pub. in Physical Review A, Vol. 32, No. 5, 2864-2878(Nov 1985).

The incoherent emission from an undulating electron beam in the presence of metallic boundaries is analyzed. A general method of solving Maxwell's equations is used to express the field of a single particle in terms of vector waveguide modes. It is shown that the radiation characteristics depend upon a parameter involving the energy wiggler wavelength, and the waveguide transverse dimension. At some values of this parameter the energy spectrum and angular distribution will differ significantly from the analogous free-space results. The amount of energy emitted into resonator modes is also analyzed in terms of a similar expansion.

45009 (AD-A-221623/2/XAB) **Quantum multimode analysis of the FEL. Technical report No. 37, 1 October 1984-30 September 1985.** Dattoli, G.; Gallardo, J.; Torre, A. California Univ., Santa Barbara, CA (USA). Quantum Inst. Jun 1985. 7p. Source: NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 31, No. 5, 3755-3760(Jun 1985).

This reprint discusses a longitudinal multimode quantum theory of the free-electron laser (FEL) within the framework of a nonrelativistic Hamiltonian. Furthermore, we study the evolution of the radiation field starting from the vacuum state and present the analytical expression in first order in the electron recoil of the probability amplitude of finding 1j photons in the longitudinal jth mode. In conclusion we show the possibility of a self-consistent formalism adequate for numerical calculations to evaluate the evolution of the FEL radiation field from the quantum to the classical regime.

45010 (AD-A-221625/7/XAB) **Far-infrared, low-loss, cylindrical-Gaussian eigenmodes of a bent rectangular waveguide free-electron-laser resonator. Technical report No. 41, 1 October 1984-30 September 1985.** Elias, L.; Gallardo, J.; Kimel, I. California Univ., Santa Barbara, CA (USA). Quantum Inst. 1 Jun 1985. 5p. Source: NTIS, PC A01/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 57, No. 11, 4870-4873(1 Jun 1985).

This reprint presents approximate analytical solutions of the Helmhotz equation for a slightly bent metallic rectangular waveguide with infinite aperture cylindrical mirrors. The low-order, overmoded, low-losses eigenmodes of the cold resonator are naturally expressed as products of cylindrical Gaussian-Hermite and trigonometric functions. In first order in perturbation theory, the correction to the attenuation constant. Modes propagate with negligible losses in the far-infrared region. These results are compatible with preliminary experimental data from the Free Electron Laser experiment.

45011 (AD-A-221626/5/XAB) **Free-electron-laser features in small-signal regime with a Gaussian mode. Technical report No. 46, 1 October 1984-30 September 1985.** Boscolo, I.; Gallardo, J.; Bernardini, P. California Univ., Santa Barbara, CA (USA). Quantum Inst. 1985. 6p. Source: NTIS, PC A02/MF A01.

Pub. in Nuclear Instruments and Methods in Physics Research, 1985.

The set of equations studying the system is made up of the Vlasov equation to describe the propagating electromagnetic field evolution. The optimized design for the optical cavity results in a ratio of the undulator length to Rayleigh length of about 3.

45012 (AD-A-221627/3/XAB) **UCSB electrostatic accelerator free-electron laser: First operation. Technical report No. 45, 1 October 1985-30 December 1985.** Elias, L.R.; Hu, J.; Ramian, G. California Univ., Santa Barbara, CA (USA). 1985. 5p. Source: NTIS, PC A01/MF A01.

A far-infrared, free electron laser, driven by a 3MeV electrostatic accelerator modified for electron beam recovery, is described. In its initial operation 400 microns, it has produced 10kW peak power in 50 microsec pulses whose time and frequency structure show unexpected behavior.

45013 (AD-A-221628/1/XAB) **Comment on photon antibunching in a free-electron laser. Technical report No. 49, 1 October 1985-30 December 1986.** Dattoli, G.; Gallardo, J.; Renieri, A.; Torre, A. California Univ., Santa Barbara, CA (USA). Quantum Inst. Nov 1985. 2p. Source: NTIS, PC A01/MF A01.

A recent paper stated that the photon-number distribution in a free-electron laser is always sub-Poissonian. This statement is clearly in contradiction with well-known published results. In the recoilless approximation the photon statistics is Poissonian. However, for electron recoil different from zero, the photon-number distribution presents bunching (anti-bunching) for positive (negative) detuning parameter.

45014 (AD-A-221629/9/XAB) **Incoherent emission of an electron beam in a free-electron-laser rectangular waveguide. Technical report No. 48, 1 October 1984-30 September 1985.** Elias, L.; Gallardo, J.; Gregoire, D. California Univ., Santa Barbara, CA (USA). Quantum Inst. 15 Aug 1985. 8p. Source: NTIS, PC A02/MF A01.

Jnl. of Applied Physics, Vol. 58, No. 4, 1432-1438(15 Aug 1985).

A calculation is presented of the incoherent radiation emitted by an electron beam of finite radius passing through a linearly polarized magnetic undulator in a rectangular waveguide with perfect conducting walls. This analysis is based on the Fourier component of the Lienard-Wiechert fields. The metallic boundary conditions are exactly incorporated in the formalism by means of the image currents method. In the Fresnel approximation, we show that the double infinite sum over images is transformed into one over vertical modes, consisting of trigonometric functions. The discreet frequency spectrum and angular distribution of the radiation are studied.

45015 (AD-A-221630/7/XAB) **Raman-Nath equation and classical diffusion on one-dimensional random chains. Technical report No. 47, 1 October 1984-30 September 1985.** Dattoli, G.; Gallardo, J. California Univ., Santa Barbara, CA (USA). Quantum Inst. 1 Feb 1985. 3p. Source: NTIS, PC A01/MF A01.

Pub. in Physical Review B, Vol. B31, No. 3, 1608-1609(1 Feb 1985).

In a recent Letter, Heinrichs discussed an exact analytical result for the long-time classical diffusion of particles on random chains

with the nearest-neighbor transfer rates having Gaussian distributions about fixed systematic (constant) rates. He has shown for static randomness, for both symmetric (S) and asymmetric transition rates (A), that the equations satisfied by the configuration-averaged probability of finding the particle at x at time t, p(x,t) can be expressed in the form of a differential, finite-difference recursive relation. These equations have appeared in many areas of physics, particularly in the quantum theory of free-electron lasers and quantum optics. In this reprint we present an alternative method for solving Eq. (4) based on the introduction of raising and lowering operators and performing simple operator algebra. This method(3) has been successfully applied to a wide class of differential-recursive equations known as Raman-Nath (RN) equations of which Eq. (4) is a particular example. Although we reach the same conclusions as in Ref. 1 and derive no new physical results, the method offers definite advantages of simplicity which should be of interest to researchers in this field.

45016 (AD-A-221631/5/XAB) **Observation of power instability and multimode behavior in a far-infrared free-electron laser. Technical report No. 52, 1 October 1985-30 December 1986.** Amir, A.; Elias, L.R.; Gregoire, D.J.; Hu, J.; Kotthaus, J.P. California Univ., Santa Barbara, CA (USA). 15 Dec 1985. 4p. Source: NTIS, PC A01/MF A01.

Pub. in Applied Physics Letter, Vol. 47, No. 12, 1251-1253(15 Dec 1985).

Measurements of the time dependence and the frequency spectrum of the output power in the far-infrared free-electron laser are reported. In typical light pulses of 20-50 microsec we have observed unexpected oscillations of the laser output with a characteristic period of 5 microsec. At the same time, the laser frequency swept over a discreet set of frequency modes, separated by 1.3 GHz. We also present measurements of the gain and loss of the optical mode and discuss the problem of the accelerator terminal voltage drop in a single electron beam pulse with relation to the light spectrum.

45017 (AD-A-221733/9/XAB) **Quantum-statistical properties of an FEL amplifier. Technical report No. 35, 1 October 1984-30 September 1985.** Dattoli, G.; Gallardo, J.; Renieri, A.; Richetta, M. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 19p. Source: NTIS, PC A03/MF A01.

We discuss the problem of photon quantum statistics of a single particle Free Electron Laser (FEL) amplifier in the small-signal cold beam regime to first order in the electron quantum recoil. The initial radiation wave is an arbitrary coherent state. We show that Glauber coherence is not preserved by the FEL interaction if the initial coherent state is not the vacuum even if we neglect the electron quantum recoil (absence of gain). We evaluate the first two moments of the final photon distribution and find sub (super)-poissonian photo statistics for negative (positive) resonance parameter.

45018 (AD-A-221734/7/XAB) **Quantum coherence properties of the FEL. Technical report No. 36, 1 October 1984-30 September 1985.** Dattoli, G.; Gallardo, J.; Renieri, A.; Richetta, M.; Torre, A. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 21p. Source: NTIS, PC A03/MF A01.

This reprint discusses the quantum coherence properties of the FEL within the single electron non-relativistic Hamiltonian picture. The problem is analyzed both in the single and multimode hypothesis.

45019 (AD-A-221735/4/XAB) **Photon statistical properties of an optical-wiggler free-electron laser. Technical report No. 38, 1 October 1984-30 September 1985.** Dattoli, G.; Gallardo, J. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 4p. Source: NTIS, PC A01/MF A01.

The Free Electron Laser Hamiltonian is used to study the statistical properties of the photons emitted in a scattering process between a coherent electromagnetic wave (optical wiggler) and a counter-propagating relativistic electron beam. It is shown that the probability distribution of exchanged photons is binomal and that coherent states are preserved by the Free Electron Laser interaction only in the absence of gain.

45020 (AD-A-221736/2/XAB) **Magnetic-tape undulators. Technical report No. 54, 1 October 1985-30 December 1986.** Kimel, I.; Yen, W.M. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Dec 1986. 11p. Source: NTIS, PC A03/MF A01.

Magnetic undulators and wigglers are an essential part of most Free Electron Laser. An interesting possibility is to make short period undulators (microundulators) out of suitably recorded magnetic tapes. Field calculations and measurements on such microundulators are reported.

45021 (AD-A-221737/0/XAB) **Micro-undulator FEL technology. Technical report No. 43, 1 October 1984-30 September 1985.** Elias, L.R.; Ramian, G. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 10p. Source: NTIS, PC A02/MF A01.

A novel technique for overcoming lower size limitations in the fabrication of permanent magnet undulators is described. An analysis of the properties of such millimeter period undulators is presented and some possible low-voltage FELs employing them are discussed.

45022 (AD-A-221738/8/XAB) **Submillimeter free-electron laser. Technical report No. 32, 1 October 1984-30 September 1985.** Elias, L.R. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 6p. Source: NTIS, PC A02/MF A01.

A major portion of this presentation is devoted to examining, in a tutorial manner the basic single-particle physics of free-electron lasers and discussing in some detail the important design considerations of the UCSB FIR FEL.

45023 (AD-A-221739/6/XAB) **Free-electron lasers and magnetic materials. Technical report No. 53, 1 October 1984-30 September 1985.** Elias, L.R.; Kimel, I.; Ramian, G. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 3p. Source: NTIS, PC A01/MF A01.

Free Electron Laser (FELs), offering coherent, tunable, high power submillimeter radiation, open exciting areas of magnetic materials research. At the same time, FELs have benefited from magnetic materials research - specifically the modern development of Rare Earth Cobalt and Neodymium-Iron-Boron permanent magnet material. Application of these materials to a new type of short period FEL undulator is described.

45024 (AD-A-221743/8/XAB) **High temperature ceramic superconductors. Quarterly progress report No. 5, 1 January-31 March 1990.** Chen, A.; Chen, K.C.; Duggan, D.M.; Montgomery, F.C.; Pak, S.S. General Atomics, San Diego, CA (USA). Mar 1990. 50p. Source: NTIS, PC A03/MF A01.

The principal objectives of this program are to demonstrate fabrication of high-temperature ceramic superconductors that can operate at or above 90 K with appropriate current density, J(c), in forms useful for application in resonant cavities, magnets, motors, sensors, computers, and other devices; and to fabricate and demonstrate selected components made of these materials, including microwave cavities and magnetic shields.

45025 (AD-A-221818/8/XAB) **X-ray-Laser Program report for FY 1989. Final report, 1 October 1988-30 September 1989.** Naval Research Lab., Washington, DC (USA). 24 May 1990. 87p. (NRL-MR-6622). Source: NTIS, PC A05/MF A01.

This report details the progress achieved by the Radiation Hydrodynamics and Pulsed Power Physics Branches in X-Ray Laser experiments and modeling during FY 1989 Significant experimental accomplishments in photopumping of neon by both neon and sodium to produce inversions via either the Auger effect or resonant photopumping are described in the first section. Subsequent sections present in detail modeling of neon-neon photopumping, recombination lasers and development of a new diagnostic for neonlike x-ray laser plasmas.

45026 (ANL-90/25) **Practical superconductor development for electrical power applications: Semiannual report, October 1989-June 1990.** Goretta, K.C. (comp.). Argonne National Lab., IL (USA). Jun 1990. 24p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE90014836. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of useful high-critical-temperature (high-T_c) superconductors requires synthesis of superconducting compounds; fabrication of wires tapes, and films from these compounds; production of composite structures that incorporate stabilizers or insulators; and design and testing of efficient components. This report describes technical progress of research and development efforts aimed at producing superconducting components based on the Y–Ba–Cu, Bi–Sr–Ca–Cu, and Tl–Ba–Ca–Cu oxide systems. Topics discussed are synthesis and heat treatment of high-$T_c$superconductors; formation of monolithic and composite wires and tapes; investigation of superconductor/metal connectors; characterization of structures and superconducting and mechanical properties; and fabrication and properties of thin films. Collaboration with industry and academia is also documented. 16 refs., 7 figs., 2 tabs.

45027 (ANL/MCT–90/1) **Impact of high-critical-temperature superconductors on electromagnetic pump applications.** Krazinski, J.L.; Holtz, R.E.; Jaross, R.A. Argonne National Lab., IL (USA). Materials and Components Technology Div. May 1990. 48p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90014809. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This study investigated the impact of the development of practical, high-critical-temperature superconducting materials on applications involving electromagnetic (EM) pumping. Potential improvements in the operating characteristics of EM pumps were examined for current pump technology. In addition, the study addressed whether the development of high-$T_c$superconductors could enable the implementation of EM pumps in applications where it has not been previously feasible. This assessment focused on two specific types of EM pumps: helical-rotor pumps with rotating field coils and EM thruster pumps for ship propulsion. The design and performance of helical-rotor pumps were analyzed for both liquid metals and nonmetallic fluids. For liquid metals, the impact of superconductors on the pump size, mass, and efficiency was examined for EM pumps operating at relatively lower magnetic field strengths. For nonmetallic fluids, the study investigated whether the use of high magnetic field strengths, in conjunction with high-$T_c$superconductors, could enable the pumping of these fluids with EM pumps of reasonable size and efficiency. The impact of high-$T_c$superconducting materials on the reliability and economics of EM pumps was also examined. In addition, the study assessed the impact of high-field-strength, superconducting magnets on the feasibility of using EM thrusters for ship propulsion. Parametric studies were conducted on the effects of magnetic field strength, thruster size, vessel speed, and vessel size on the predicted thruster efficiencies. The results were compared with these of earlier studies on electromagnetic propulsion that incorporated both superconducting and nonsuperconducting magnet designs. 34 refs., 15 figs., 9 tabs.

45028 (CONF-900368–5) **Operation of a ten liter discharge XeCl laser.** Bollanti, S.; Di Lazzaro, P.; Flora, F.; Giordano, G.; Gerardino, A.; Letardi, T.; Lisi, N.; Schina, G.; Zheng, C.E. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 8p. From International conference on optical science and engineering; Hague (Netherlands); 12-16 Mar 1990. Order Number DE90514418. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the international congress on optical science & engineering (The Hague, 12-16 Mar 1990).

A 10 liter active volume, x-ray preionized XeCl laser has been operated with both a conventional spark-gap switched discharge and a x-ray triggered one. In the last case, 45 W average output power was obtained. A simple model has been developed to study the minimum conditions on the preionized source to drive a uniform switchless discharge.

45029 (CONF-901062–1) **High-temperature superconductors: Their potential for utility applications.** Giese, R.F. (Argonne National Lab., IL (USA)); Sheahen, T.P.; Wolsky, A.M.; Sharma, D.K. Argonne National Lab., IL (USA). [1990]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 1. joint IEEE/PES international power meeting; New Delhi (India); 28 Oct - 1 nov 1990. Order Number DE90009704. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A number of proposed applications of superconductivity for the electric utility sector are described, the current status of their development is summarized, and the potential impact of successful development of high-temperature superconductors (HTSC's) is discussed. Performance goals for development of HTSCs are presented and compared with the current status of development of HTSCs. Applications discussed include large-scale generators, motors, transmission lines, magnetic storage, transformers, power electronics, and fault-current limiters. 15 refs., 1 fig., 3 tabs.

45030 (CONF-901088–3) **Preparation of superconducting wire by deposition of $YBa_2Cu_3O_x$ onto fibers.** Lackey, W.J. (Georgia Inst. of Tech., Atlanta, GA (USA)); Hanigofsky, J.A.; Shapiro, M.J.; Carter, W.B.; Hill, D.N.; Barefield, E.K.; Judson, E.A.; O'Brien, D.F.; Chung, Y.S.; Moss, T.S.; More, K.L. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. Department of Defense; U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 11. international conference on chemical vapor deposition; Seattle, WA (USA); 14-19 Oct 1990. Order Number DE90013380. Source: NTIS, PC A03/MF A01 - OSTI.

A controllable process has been developed for chemical vapor deposition of superconducting $YBa_2Cu_3O_x$. The process relies on feeding and transport of a finely ground powder mixture of Y, Ba, and Cu tetramethylheptanedionates into a CVD furnace. X-ray diffraction, scanning electron microscopy, analytical electron microscopy, analytical electron microscopy, resistance versus temperature, and critical current measurements have been used to characterize the films. The optimum processing parameters were determined using parametric studies involving temperature, pressure, reagent feed rate and composition, and coating time. Extensive c-axis orientation was observed using x-ray diffraction and transmission electron microscopy. The presence of impurity phases and substrate coating interaction layers were observed. $YBa_2Cu_3O_x$ coatings on MgO (100) single crystal substrates exhibited critical currents of 2×10^4 A cm^2 at 77 K, 0 Tesla, with critical temperatures (Resistance=)0 of 86 K. Deposition of the $YBa_2Cu_3O_x$ material onto several fibrous substrates has been achieved, and a continuous fiber coating furnace is in operation. 26 refs., 13 figs., 2 tabs.

45031 (CRN-CPR–89-04) **Study and construction of a high frequency power preamplifier applying thick film hybrid technology.** Bakir, B. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1989. 128p. (In French). Order Number DE90514620. Source: NTIS (US Sales Only), PC A07/MF A01.

Two hybrid circuit manufacturing techniques are compared. The circuits are used in high frequency range devices. One circuit is manufactured on a copper coated epoxy substrate, using classical printed circuit method. The second circuit is fabricated on ceramic (aluminia 96%) substrate, by means of the serigraphy of conducting paths and resistances. Among the advantages of the thick film hybrid technology, the power dissipation factor, the conductor adherence and the minimization of undesirable effects, may be pointed out. The metal coatings are resistant to the dissolving phenomenum caused by the tin-lead-silver welding process. The described circuits are light and the few number of welded joints allow the obtention of high strength, high reliability and low maintainance cost systems.

45032 (ENEA-RT-TIB–88-50) **Theory of FEL gain: A simple parametrization method.** Dattoli, G.; Torre, A.; Giannessi, L.; Caloi, R. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base; Rome Univ. (Italy). Ist. di Fisica. Nov 1989. 18p. (RT/TIB–88-50). Order Number DE90514415. Source: NTIS (US Sales Only), PC A03/MF A01.

In any free electron laser (FEL) experiment, the crucial quantities to be optimized are the gain and the efficiency. Large FEL efficiency can be achieved by either tapering the undulator or recovering the e-beam, or by a combination of both methods. The gain is indeed a function of the e-beam, undulator and cavity parameters and such dependencies are not separate functions. The beam emittances may, e.g., pose limitations on the cavity control system, or on the choice of the number of undulator periods and so on.

45033 (ENEA-RT-TIB–89-27) **Excimer laser: Status and perspectives.** Bollanti, S.; Letardi, T. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Nov 1989. 30p. (CONF-890697–4: NATO Advanced Study Institute on non-equilibrium processes in partially ionized gases, Acquafredda di Maratea (Italy), 4-17 Jun 1989; RT/TIB–89-27). Order Number DE90514416. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the NATO-ASI non equilibrium processes in partially ionized gas (Acquafredda di Maratea, 4-17 Jun 1989).

In this paper, a status of the art of the excimer lasers is reported. After some general remarks, attention is fixed on rare gas halide lasers (RGH), in particular, on the self-sustained discharge pumped ones. Problems related to a stable discharge development are considered and related technological requirements are deduced. Considerations on the propagation of light beams in inverted media show the best way to exploit the active volume. Moreover, a brief review of excimer lasers with unconventional characteristics is done, and finally a few examples of experimental techniques to measure relevant laser parameters are reported.

45034 (ENEA-RT-TIB–89-30) **Non Hermitian evolution of two-level quantum systems.** Dattoli, G.; Torre, A.; Mignani, R. ENEA, Frascati (Italy). Centro Ricerche Energia; Rome Univ. (Italy). Ist. di Fisica. Nov 1989. 31p. (RT/TIB–89-30). Order Number DE90514481. Source: NTIS (US Sales Only), PC A03/MF A01.

Submitted to Physical Review A.

A feeling of reluctance is widespread among physicists against the use of non-Hermitian Hamiltonians and, consequently, of non-Hermitian Schrodinger equations (nHSe), to treat physical problems. Recently, in connection with various problems ranging from multiphoton ionization, to transverse mode propagation in optical resonators and to free electron lasers, rigorous and practical methods have been developed to study the time-dependence of nHS equations. The deep reasons underlying the non-Hermiticity of a Hamiltonian describing a physical process can be traced back to the Fock-Krylov theorem. The theorem states that the necessary and sufficient condition for a quantum mechanical state to be a truly decaying state is that the energy distribution of the state be a continuous. The possibility of treating any system, with a part or the whole of its motion in the continuum, as a decaying state is therefore ensured by the virtue of this theorem. This paper discussed the solution, using a suitably developed algorithm, of the time dependent nHSe of a two-level system based on the spinor image solution technique of parabolic type equations. An analysis is made of the mathematical aspects of the two state models with effective decay terms in a non-Hermitian Hamiltonian. Owing to their relative simplicity, they may represent a systematic investigative tool for quantum theory of multiphoton ionization.

45035 (ENEA-RT-TIB–89-32) **Electric field distribution and electrode design for the excimer discharge laser.** Ciocci, F.; Hermsen, T. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Nov 1989. 14p. (RT/TIB–89-32). Order Number DE90514417. Source: NTIS (US Sales Only), PC A03/MF A01.

In gas discharge lasers, proposed electrode profiles fail to take into account the presence of nearby current return parts of the circuit, often sited near the electrodes to obtain a low impendance of the laser head and which may alter the field uniformity. Part one of this paper presents the results of a numerical study of the electrostatic field distribution in the 10 l excimer laser discharge chamber, developed at the ENEA (Italian Commission for Alternative Energy Sources) Centre of Frascati, by means of a computer code which solves the Laplace equation with boundary conditions given by the actual configuration and electrode profiles. An alternative configuration for the current return parts is given which, in part, should solve the existing non-uniformity of about 20% in the electric field between the electrodes. As a further example, the equipotentials are shown for a particular double discharge configuration in which one part serves as an oscillator and the other as an amplifier. In this case, there are no passive current returns since the current loop is naturaly closed by the electrodes. Part two treats in more detail electrode profile design and presents some possible profiles (not all new) obtained by analytical methods for simplified configurations.

45036 (ENEA-RT-TIB–89-33) **Carbon dioxide laser measurement of absorption coefficient of gases (remote sensing of air pollution).** Barbini, R.; Colao, F.; Palucci, A.; Ribezzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Nov 1989. 31p. (In Italian). (RT/TIB–89-33). Order Number DE90514413. Source: NTIS (US Sales Only), PC A03/MF A01.

Within the framework of ENEA (Italian Commission for Alternative Energy Sources) studies on remote TEA carbon dioxide laser monitoring of the earth's atmosphere, lab measurements were made of the absorption coefficient of various polluting gases (ammonia, ethylene and ozone). The measurements were made at different laser emission wavelenghts. The conditions in which the gases naturally occur in the atmosphere were simulated. Based on the obtained data, the laser parameters (such as energy, gas partial pressure and cell length) were optimized. This report provides the design and performance characteristics of the laser, as well as the criteria for data acquisition, selectioning and statistical processing.

45037 (ENEA-RT-TIB–89-38) **An introduction to the theory of free electron lasers.** Dattoli, G.; Giannessi, L.; Torre, A.; Depanfilis, S. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1990. 38p. (RT/TIB–89-38). Order Number DE90514424. Source: NTIS (US Sales Only), PC A03/MF A01.

Presented at the CERN DL Accelerator School - Course on Synchrotron Radiation and Free Electron Lasers, Chester, UK, 6-13 Apr 1989.

This paper reviews the theory of the free electron laser, with reference to the low and high gain regimes. Included is a discussion of saturation effects, in both single passage and recirculated devices, an analysis of the mode-locking mechanism when the laser is operating with a bunched e-beam, and finally comments on the spatial coherence length of the FEL.

45038 (ENEA-RT-TIB–89-54) **A long pulse, high energy, narrow bandwidth carbon dioxide laser for doppler wind LIDAR applications.** Barbini, R.; Belli, P.L.; Bitelli, G.; D'Amato, F.; Giorgi, M.; Galletti, E.; Stucchi, E.; Ferrario, A. ENEA, Frascati (Italy). Centro Ricerche Energia; Centro Informazioni Studi Esperienze (CISE), Milan (Italy). May 1990. 15p. (RT/TIB–89-54). Order Number DE90514414. Source: NTIS (US Sales Only), PC A03/MF A01.

This paper describes the development of a carbon dioxide laser source with high energy (approx. 10 J/pulse), long pulses (approx. 2 microseconds), narrow bandwidth (approx. 200 kHz), and with a suitable discharge device (Lumonics 602) and cavity configuration (modified Self Filtering Unstable Resonator). An assessment is made of the feasibility of the high energy laser for long range, ground and satellite based, wind velocity measurements. The spectral behaviour is near to satisfying Doppler wind LIDAR requirements, the only problem being the fraction of pulse energy contained in the pulse peak, which is dispersed over a broad frequency spectrum. This can be a problem when looking at a very high velocity resolution and very long range measurements. A frequency bandwidth reduction is expected, at the expense of some output energy reduction, by working at sub-atmosphere pressure and with a nitrogen enriched gas mixture, in order to enhance the tail/spike amplitude ratio and thus to reduce the spike-related spectral broadening.

45039 (EPRI-CU–6883) **Commercial and industrial applications of adjustable-speed drives: Final report.** Poole, J.N.; Moran, J.P.; Seitzinger, D.L.; Johnson, T.W.; Stengl, G.R.; Salib, S.; Wangerin, D.D. Electric Power Research Inst., Palo Alto, CA (USA); CRS Sirrine, Inc., Raleigh, NC (USA). ©Jul 1990. 309p. Sponsored by Electric Power Research Institute. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The objective of the project was to identify, design, and install four ASD retrofit applications and evaluate the actual energy savings of each of the projects with field data. This project also examines the power quality concerns associated with ASD applications from a theoretical aspect as compared to actual field data taken at all but one of the sites following the ASD installation. Not only does this report provide case histories of the retrofits, it provides some guidance in the selection and evaluation of potential ASD retrofits with some exposure to the technical foundations of ASD design and harmonic analysis. 14 refs., 291 figs., 12 tabs.

45040 (ETDE-IT–90-23) **The 3-D FEL pulse propagation equation: An analytical treatment in the low gain and small**

signal regime. Dattoli, G.; Torre, A.; Fang, H.; Gallardo, J.C.; Richetta, M. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 42p. Order Number DE90514421. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Physical Review A.

This paper shows that the transverse mode evolution of a FEL operating with short pulses can be treated, in the small signal and low gain regime, using a relatively simple mathematical technique leading to a potentially fast numerical algorithm. It is also pointed out that analytical solutions can be obtained for the cases where the slippage length is small compared to the longitudinal bunch length.

45041 (ETDE-IT–90-27) **LiF films: Production and characterization.** Montereali, R.M.; Baldacchini, G.; Martelli, S.; Scavarda do Carmo, L.C. ENEA, Casaccia (Italy). Centro Ricerche Energia. Oct 1989. 18p. (CONF-8909355–1: 75. annual meeting of the Italian Physical Society, Cagliari (Italy), 28 Sep 1989). Order Number DE90514502. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 75th annual congress of the Italian Physical Society (Cagliari, 28 Sep-3 Oct 1989).

Within the framework of studies directed toward the attempt to use LiF as a host for laser active impurities or room temperature stable colour centre lasers, LiF films were produced by thermal evaporation on amorphous substrates kept (during evaporation) at temperatures ranging from ambient up to 350 degrees C. The evolution through two polycrystalline states was analysed by x-ray diffraction techniques that also revealed that the LiF films' lattice parametre is equal to that of the LiF crystal. The refractive index of the produced films was measured by transmission optical interferometry. Talisurf-6 profilometer measurements on film surfaces show sharp edges and very smooth surfaces, that reflect the substrate ones.

45042 (ETDE-IT–90-28) **LiF film. Absorption and luminescence of colour centres.** Montereali, R.M.; Baldacchini, G.; Scavarda do Carmo, L.C. ENEA, Casaccia (Italy). Centro Ricerche Energia. Sep 1989. 10p. (CONF-8909355–2: 75. annual meeting of the Italian Physical Society, Cagliari (Italy), 28 Sep 1989). Order Number DE90514503. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 75th annual congress of the Italian Physical Society (Cagliari, 28 Sep-3 Oct 1989).

Colour centre lasers operate usually at liquid nitrogen, but some success has been reported on room temperature active colour centres in LiF crystals. In these crystals F_2 and $F_{3supplus}$ centres (respectively two electrons bound to two or three neighbouring anionic vacancies, the last one being a charged defect) were produced and analysed for use room temperature lasers. In this work, LiF films, 1 micron thick, were produced by thermal evaporation on amorphous silica substrates. The films were subjected at room temperature to an e-beam irradiation energy of 3 KeV and a current of 120 micro A on about 0.5 square centimeters. This irradiation produced room temperature stable F_2 and $F_{3supplus}$ centres that were observed by light absorption measurements. Although the concentration of the centres was much higher than that obtained usually in bulk crystals, the luminescence was also observed.

45043 (ETDE-IT–90-58) **Photoluminescence in LiF films colored by electron beam.** Montereali, R.M.; Baldacchini, G.; Scavarda do Carmo, L.C. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Apr 1990. 12p. (CONF-900419–7: 8. international triennial conference on thin films and the 17th international conference on metallurgical coatings, San Diego, CA (USA), 1-6 Apr 1990). Order Number DE90514531. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 8th international conference on thin films (San Diego, 2-6 Apr 1990).

Colour centre lasers operate usually at liquid nitrogen, but some success has been reported on room temperature active colour centres in LiF crystals. In these crystals, F_2 and $F_{3-supplus}$ centres (respectively two electrons bound to two or three neighbouring anionic vacancies, the last one being a charged defect) were produced and analysed for use as room temperature lasers. The present interest on miniaturization has called for developments in the techniques of production and characterization of thin films. Within the framework of this research, LiF films, 1 micron thick, were produced by thermal evaporation on amorphous silica substrates. X-ray diffraction showed the existence of a polycrystalline structure. The films were subjected at room temperature to an e-beam irradiation energy of 3 KeV and a current of 120 micro A on approx. 0.5 square centimeters. This irradiation produced temperature stable F_2 and $F_{3-supplus}$ centres that were observed by light absorption measurements. Although the concentration of the centres was much higher than that obtained usually in bulk crystals, the luminescence was also observed.

45044 (GAO/RCED–90-37) **Federal research: The Sematech consortium's start-up activities.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 44p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

Since the early 1980s, the U.S. semiconductor industry has lost to Japan a significant portion of its market share for semiconductors. In response to this loss, several U.S. semiconductor and computer companies formed a group to conduct the research and development needed to restore the U.S. role as a world leader in semiconductor manufacturing. Congress authorized DOD to participate in this group and appropriated $100 million in fiscal year 1988 and $100 million in fiscal year 1989. Member companies must provide at least half the $200 million annual operating budget. Over the 5 years that the group is expecting to receive federal funding, GAO will assess it's progress. This report addresses the federal role in the group's approach and organization for achieving its overall objectives, and its initial technology transfer activities.

45045 (IREQ–714U628) **Technological impact of superconductivity at liquid nitrogen temperature analysis of opportunity cases.** Begin, G.; Critchlow, P.; Roberge, R. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). Dec 1989. 228p. (CE–03109). Source: Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of this study were to establish the impact of high temperature superconductivity (HTSC) on the design and cost of power engineering equipment; to identify the most viable applications of high temperature technologies for Canadian utilities; and to evaluate their potential impact on electricity consumption. A comprehensive search of the literature was undertaken to locate designs of electrical equipment conceived to incorporate superconducting materials, normally for helium temperature operation. These designs were then modified; replacing helium cooling with nitrogen systems and making simple modifications to eliminate redundant features. Costs and performance of the altered designs were determined, in many cases using information given in the original article. Although no HTSC conductor has yet been fabricated, it is reasonable to expect that most superconducting applications will benefit from higher temperature operation, either from an increase in efficiency or from life-cycle cost savings. At present, the main barriers preventing the use of HTSC in large scale applications are the low critical current density, and the unavailibility of wires that are flexible at operation temperatures. 130 refs., 9 fig., 9 tabs.

45046 (OH/RD–89-280-K) **Trip report: 1989 Cryogenic engineering conference/International cryogenic materials conference.** Robins, J.R. Ontario Hydro Research Div., Toronto, ON (Canada). 16 Nov 1989. 10p. (MICROLOG–90-03523). Source: PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

This report provides an outline of presentations attended by Ontario Hydro's observer at a conference on cryogenic engineering and materials. Summaries are provided of some presentations on high-temperature superconductors and their applications, including wire. Developments in cryogenic refrigeration and cryogenic engineering are also reviewed. In addition, a discussion is presented on flux pinning and critical current density in conventional low-temperature superconductors. A list of 6 future meetings on cryogenics and superconductivity is appended.

45047 (ORNL/ATD–39) **Performance test plan for variable-speed ac superconducting motor.** Hawsey, R.A. (Oak Ridge National Lab., TN (USA)); Campbell, V.W.; Kahl, W.K.; McConnell, B.W.; Luton, J.N.; Schwenterly, S.W.; Sohns, C.W.; Bailey, J.M. Oak Ridge National Lab., TN (USA). May 1990. 51p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016208. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A test plan for evaluation of the performance characteristics of an axial-air-gap, variable-speed ac superconducting motor is presented in this report. A complete description of the electrical and mechanical apparatus and the instrumentation requirements is provided. Static and dynamic testing of the motor will enable comparison of a motor performance as a function of speed, load, and air-gap flux density with an analytical model.

45048 (PB–90-872854/XAB) **Sensors and detectors based on superconducting devices. July 1982-May 1990 (A Bibliography from the EI Engineering Meetings data base). Report for July 1982-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 96p. Source: NTISPC N01/MF N01.

Supersedes PB–89-859045.

This bibliography contains citations from conference proceedings concerning gradiometers, magnetometers, and infrared detectors which use superconductors to improve sensitivity. Applications include biomagnetic measurements for medical studies, gravity wave experiments, geomagnetism and ocean bottom magnetic exploration, galvanometers and voltmeters, and bolometers and radiometers. Some articles refer to design considerations for cooling systems for the sensors and detectors, and fabrication techniques for squids (superconducting quantum interference devices.) (This updated bibliography contains 189 citations, 74 of which are new entries to the previous edition.)

45049 (PB–90-873357/XAB) **Laser window materials. January 1975-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 101p. Source: NTISPC N01/MF N01.

Supersedes PB–88-858303.

This bibliography contains citations concerning studies of laser window materials, properties, and improvement techniques. Optical absorption, laser induced damage and optical distortion, and contaminant identification in laser window materials are discussed. Coating design, contamination control, laser calorimetry, and absorption measuring techniques are presented. (This updated bibliography contains 180 citations, 31 of which are new entries to the previous edition.)

45050 (PB–90-873563/XAB) **Neodymium YAG (yttrium aluminum garnet) lasers. January 1970-June 1990 (A Bibliography from the NTIS data base). Report for January 1970-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 138p. Source: NTISPC N01/MF N01.

Supersedes PB–88-869482.

This bibliography contains citations concerning design, fabrication, and testing of neodymium doped yttrium aluminum garnet lasers. Included are citations covering such areas as quantum efficiency, stabilization, mode locking, frequency conversion, and modulation. Some laser applications are included, especially if the citation covers design confirmation or comparison with other types of lasers. Some of these applications are optical communications, range finding, tracking, cutting, drilling, and welding. Safety hazards and radiation damage are also referenced in a few citations. (This updated bibliography contains 253 citations, 27 of which are new entries to the previous edition.)

45051 (PB–90-873860/XAB) **Sensors and detectors based on superconducting devices. July 1972-July 1989 (A Bibliography from the International Aerospace Abstracts data base). Report for July 1972-July 1989.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 161p. Source: NTISPC N01/MF N01.

See also PB–90-873878; U.S. sales only.

This bibliography contains citations concerning gradiometers, magnetometers, and infrared detectors which use superconductors to improve sensitivity. Applications include biomagnetic measurements for medical studies, gravity wave experiments, geomagnetism and ocean bottom magnetic exploration, galvanometers and voltmeters, astronomical telescopes, and bolometers and radiometers. Some articles refer to design considerations for cooling systems for the sensors and detectors. (This updated bibliography contains 389 citations, none of which are new entries to the previous edition.)

45052 (PB–90-873878/XAB) **Sensors and detectors based on superconducting devices. August 1989-June 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for August 1989-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 46p. Source: NTISPC N01/MF N01.

Supersedes PB–89-868244. See also PB–90-873860; U.S. sales only.

This bibliography contains citations concerning gradiometers, magnetometers, and infrared detectors which use superconductors to improve sensitivity. Applications include biomagnetic measurements for medical studies, gravity wave experiments, geomagnetism and ocean bottom magnetic exploration, galvanometers and voltmeters, astronomical telescopes, and bolometers and radiometers. Some articles refer to design considerations for cooling systems for the sensors and detectors. (This updated bibliography contains 81 citations, all of which are new entries to the previous edition.)

45053 (SAND–90-1166C) **Repetitive-pulse lifetime, statistical results of design/process factor matrix study of liquid-impregnated, discrete film/foil capacitors.** Harris, J.O. Jr. (Sandia National Labs., Albuquerque, NM (USA)); MacDonald, M.J.; Thompson, M.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010167–1: CARTS-EUROPE '90 capacitor and resistor technology symposium, Bordeaux (France), 8-10 Oct 1990). Order Number DE90015565. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Two design/process factor matrix studies have been performed utilizing the Sandia-designed and developed liquid-impregnated, discrete multilayer film and foil capacitor technology. Repetitive 1 kHz charge/discharge cycle lifetimes were utilized to evaluate the process-factor variable changes in the capacitor fabrication processes. Of the five process variables investigated (perfluorcarbon liquid type, fill pressure, film crystalline to amorphous ratio or film condition, number of film layers at constant total thickness, and winding tension or space factor), only the fill pressure and film condition were shown to statistically affect the cycle lifetimes. However, definite performance improvement trends, particularly for capacitors fabricated with the 8-μm thick film, were found for the higher winding tension levels. The eighty-seven capacitors fabricated for these matrix studies functioned at 20 J/kg energy density, and seven survived 100 million cycles. All were tested in a 7°C oil bath. (Sandia National Laboratories has routinely fabricated capacitors of similar design with an energy density of 100 J/kg that have demonstrated reliabilities exceeding 0.999). For these two matrix studies, lifetimes ranged from 120 thousand cycles to the 100 million cycle upper test limit with capacitors charged to 5 kV and with the total film, dielectric-pad thickness held constant at 24 μm. 11 refs., 4 tabs.

45054 (SAND–90-1845C) **Implementing QML [Qualified Manufacturers List] for radiation hardness assurance.** Winokur, P.S.; Sexton, F.W.; Fleetwood, D.M.; Terry, M.D.; Shaneyfelt, M.R.; Dressendorfer, P.V.; Schwank, J.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900723–15: 27. IEEE annual international nuclear and space radiation effects conference, Reno, NV (USA), 16-20 Jul 1990). Order Number DE90015697. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Statistical process control (SPC) of technology parameters relevant to radiation hardness, test structure to Integrated Circuit (IC) correlation, and extrapolation from laboratory to threat scenarios

are keys to implementing Qualified Manufacture's List (QML) for radiation hardness assurance in a cost-effective manner. Data from approximately 300 wafer lots fabricated in Sandia's 4/3-μm and Complementry Metal Oxide Semiconductor (CMOS) IIIA (2-μm) technologies are used to demonstrate approaches to, and highlight issues associated with, implementing QML for radiation-hardened CMOS in space applications. An approach is demonstrated to implement QML for signal-event upset SEU immunity on 16k SRAMs that involves relating values of feedback resistance to system error rates. It is seen that the process capability indices, C_p and C_{pk}, for the manufacture of 400 kΩ feedback resistors required to provide SEU tolerance do not conform to "6σ" quality standards. For total-dose, ΔV_{tt} shifts measured on transistors are correlated with circuit response in the space environment. SPC is illustrated for ΔV_{tt}, and violations of SPC rules are interpreted in terms of continuous improvement. Finally, design validation for SEU, and quality conformance inspections for total-dose, are identified as major obstacles to cost-effective QML implementation. Techniques and tools that will help QML provide real cost savings are identified as physical models, three-dimensional device-plus-circuit codes, and improved design simulators. 29 refs., 10 figs., 1 tab.

45055 (SAND–90-1944C) **Sodium-neon resonant photoexcitation soft x-ray laser experiments on Saturn.** Porter, J.; Spielman, R.; Matzen, K.; McGuire, G.; Hussey, T. Sandia National Labs., Albuquerque, NM (USA). [1990]. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9008128–1: SDIO/T/IS ultra shrot wavelength laser briefing, Washington, DC (USA), Aug 1990). Order Number DE90014946. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper summarizes progress made at Sandia Laboratories on x-ray lasers. Experiments have demonstrated two main requirements necessary for constructing a radiation pumped soft x-ray laser: (1) a source of sufficient intensity to produce high grain and (2) creation of a significant population of neon ions close to the pump. (FSD) 11 figs.

45056 (SAND–90-2048C) **A pipelined 650 MHz GaAs 8K ROM with translation logic.** Chun, Jino (GigaBit Logic, Newbury Park, CA (USA)); Enam, Syed; Kang, D.; Remund, B. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010169–1: 1990 IEEE GaAs IC symposium, New Orleans, LA (USA), 7-10 Oct 1990). Order Number DE90015395. Source: NTIS, PC A02/MF A01 - OSTI.

The first commercially available GaAs 8K ROM has been designed and manufactured using GigaBit Logic's 3-level metal E/D process. The worst case clock frequency of 650 MHz has been obtained with a power dissipation of 3.5 W. The ROM is organized as 1K X 8 bits, and on-chip translation logic enables the ROM to have an effective 4K X 8 resolution when used a a sine look-up table. The ECL compatible ROM is packaged in GigaBit Logic's standard 40 pin package.

45057 (UCRL–101555) **Model calculations for a 600 Å laser based on photopumping of MO^{6+} by a spectral line of MO^{11+}.** Klapisch, M.; Cohen, M.; Goldstein, W.H.; Feldman, U. Lawrence Livermore National Lab., CA (USA). Jul 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907130–6: 9. international conference on vacuum ultraviolet radiation physics, Honolulu, HI (USA), 17-21 Jul 1989). Order Number DE90015202. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We assess aspects of the feasibility of a recent proposal to use the coincidence between a Mo^{11+}, 136.499 Å, line and a $4p^6 - (4p^5)_{1/2}6s$, J = 1, transition of Mo^{6+}, to obtain amplified spontaneous emission around 600 Å. A collisional-radiative model for the Mo^{6+} ion, including resonant photoexcitation of the $4p^5{}_{1/2}6s$ level, was constructed using the HULLAC atomic physics package. The model included the $4s^24p^6$; $4p^54d,4f$; $4p^55s,5p,5d$; $4p^56s,6p,6d$; $4s4p^64d,4f$; $4p^64d^2$ and $4s^24p^44d^2$ configurations, amounting to 193 levels. All configuration interactions and collisional mixing was taken into account. A gain of 3 cm^{-1} is obtained for the $4p^56s(J = 1)–4p^55p(J = 2)$ transition at 645 Å with T_e = eV, $n_e = *10^{18}$ cm^{-3}, and an effective radiation temperature of $T_{rad} > 40$ eV for the pump transition. Other transitions exhibit lower gains. 18 refs., 4 figs., 1 tab.

45058 (UCRL-JC–102565) **High voltage picosecond pulse generation using avalanche diodes.** McEwan, T.E.; Hanks, R.L.; Kilkenny, J.D. Lawrence Livermore National Lab., CA (USA). Jul 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–20: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015194. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The generation of kilovolt-level sub-100ps wide pulses using the avalanche transit-time effect in abrupt junction P+NN+ silicon diodes is described and the basic theory for this "single-shot" mode of the microwave TRAPATT oscillator is discussed. We then present a computationally efficient SPICE model and compare simulations to lab data for two basic circuit configurations. 7 refs., 8 figs.

45059 (UCRL-JC–103327) **A 150 kV, 2.5 ns, 100 Hz Blumlein pulser.** Cravey, W.R.; Freytag, E.K.; Leighton, K.S. Lawrence Livermore National Lab., CA (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006176–12: 19. power modulator symposium, San Diego, CA (USA), Jun 1990). Order Number DE90015617. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The following paper describes a series of modifications made on a Febetron x-ray machine at Lawrence Livermore National Labortary to provide a repetitive, fast rise time, high voltage pulser. The 10-Hz electron beam machine was modified to produce a pulser capable of generating a 150 kV, 2.5 ns FWHM pulse at a frequency of 100 Hz with less than a 1 ns rise time. A secondary self-breaking output switch was designed to eliminate the prepulse of the pulser output. In addition, a 150 kV output cable was added to the pulser to drive an external load. Detailed explanations of each modification will be presented. 7 refs., 11 figs., 1 tab.

45060 Ionizing radiation effects in MOS devices and circuits. Ma, T.P. (Dept. of Electrical Engineering, Yale Univ., New Haven, CT (US)); Dressendorfer, P.V. 587p. John Wiley and Sons Inc., New York, NY (USA) (1989).

This book presents an overview on the impact of ionizing radiation on metal-oxide-semi-conductor (MOS) devices and integrated circuits. Topics covered include Radiation-induced interface traps and Process-induced radiation effects.

45061 Ti:sapphire laser performance above 15 W cw with line narrowing. Bass, I.L. (Colorado School of Mines, Golden, CO (USA). Research Inst.); Bonanno, R.E.; Braun, D.G.; Delos-Santos, K.; Erbert, G.V.; Hackel, R.P.; Haynam, C.A.; Paisner, J.A. pp. 33-35 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

This paper reports over 17 W of cw output at less than 0.5 GHz linewidth obtained from a Ti:sapphire laser pumped by 2 argon-ion lasers. Thermal instability at high pump powers was controlled by cooling the laser rod.

45062 Passive mode locking of a Ti:Al_2O_3 laser with a nonlinear coupled cavity. Goodberlert, J. (USDOE Bonneville Power Administration, Vancouver, WA (USA). Div. of Labs.); Wang, J.; Fujimoto, J.G.; Schulz, P.A.; Henion, S. pp. 16-19 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). Grant F49620-88C9-0089. (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

Recently, titanium sapphire (Ti:Al_2O_3) has emerged as an attractive solid state material for laser and laser amplification applications. The crystal features high thermal conductivity and a small gain cross section, ~ 3 x 10– 19 cm^2, which allow room temperature operation with high energy storage and high output intensity. In this paper, the authors investigate ultrashort pulse generation using mode-locking techniques in Ti:Al_2O_3. Active mode-locking

performance in Ti:Al_2O_3 as well as pulse shortening with the use of a nonlinear external cavity is described. The first demonstration of passive mode-locked behavior in the Ti:Al_2O_3 laser is also presented.

45063 Laser performance and spectroscopy of Cr^{3+} in $LiCaAlF_6$ and $LiSrAlF_6$. Chase, L.L. (Lawrence Livermore National Lab., CA (USA)); Payne, S.A.; Smith, L.K.; Kway, W.L.; Newkirk, H.W.; Chai, B.H.T.; Long, M. pp. 71-76 of Proceedings of the OSA on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). DOE Contract W-7405-ENG-48. (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

The authors report on the laser measurements and relevant spectroscopic properties of the materials $LiCaAlF_6:Cr^{3+}$ (Cr:LiCAF) and $LiSrAlF_6:Cr^{3+}$ (Cr:LiSAF). Laser-pumped laser measurements show that slope efficiencies of >50% are attainable with currently available Cr:LiCAF material, and that efficiencies of 67% should ultimately be achievable. Efficiencies of 36% have been measured for Cr:LiSAF. The absorption and emission properties, and the direct measurements of the excited state absorption loss, support the data concerning the lasing efficiencies and tuning ranges. Flashlamp-pumped operation of Cr:LiCAF has provided electrical efficiencies of 1.55% thus far, and the authors expect to obtain performance comparable to that of alexandrite in the future (which is 4% efficiency in the present apparatus).

45064 Lasers for spectroscopy. Murray, J.R. (Lawrence Livermore National Lab., CA (USA)). pp. 91-174 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper reviews the underlying physics and the technology of the most common spectroscopic laser sources. The author discusses the issues governing which laser sources and technologies one might choose to implement a particular spectroscope experiment. Properties of the most important spectroscopic lasers are described.

45065 Neodymium ground state depleted laser characterization and demonstration. Beach, R. (Lawrence Livermore National Lab., CA (USA)); Solarz, R.; Mitchell, S.; Krupke, W.; Brewer, L.; Weinzapfel, S. pp. 146-147 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

A recently proposed class of rare earth doped solid state lasers is described. These ground state depleted (GSD) lasers are characterized by a low laser ion doping density (5–10 x 10^{18} ions/cc) and a large fractional excited population inversion density (4–8 x 10^{18} ions/cc). For efficiency, these lasers must be pumped by narrow-band (<few nm), intense (>10–50 kW/cm^2) sources. Four level operation at room temperature is obtained and efficient lasing to the ground electronic state manifold is achieved. The design domain of GSD lasers is dominated by the pump transition cross section (2–10 x 10– 20 cm^2) and the associated saturation fluence/flux (2–10 J/cm^2 and 10–50 kW/cm^2). The GSD laser gain element is typically optically thick (Lambert law) at the pump wavelength, but is substantially bleached at the working pump intensity.

45066 Enhanced energy-tranfser process in codoped solid state laser materials. Hartman, F.X. (Brookhaven National Lab., Upton, NY (USA). Chemistry Dept.); Rotman, S.R. pp. 195-200 of Proceedings of the OSA on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

Enhanced energy transfer between donors and acceptors can be achieved in materials in which donor- acceptor pairing occurs. Theoretical analysis and experimental examples are presented. The authors have developed a model for Foerster-Dexter energy transfer for both the multipole and exchange interactions in the case of the correlated placement of both donors and acceptors. They have analyzed recently published data on energy transfer in Nd,Er:YAG. A close fit to the neodymium decay can be found by assuming that the neodymium and erbium have a smaller than average probability of colocating next to one another.

45067 Gd^{3+}-$3+$ energy transfer and Cr^{3+} decay dynamics in Cr^{3+}-doped GSGG, GSAG, and GGG. Hamilton, D.S. (Connecticut Univ., Storrs, CT (USA). Inst. of Materials Science); Lyu, L.J.; Sliwczuk, U.; Pogatshnik, G.J.; Cain, L.S. pp. 201-206 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

A rapid energy transfer from the Gd^{3+} ions to the Cr^{3+} ions int he chromium doped gadolinium garnets GSGG, GSAG and GGG has been investigated. The process is characterized by a rapid energy migration on the Gd sublattice and a rate limiting $Gd^{3+} \rightarrow Cr^{3+}$ step. The nonexponential Cr^{3+} decay kinetics are interpreted in terms of the structural disorder of the garnets.

45068 Performance of Ho:Tm:Cr:YAG and Ho:Tm:Er:YAG as a function of temperature. Barnes, N.P. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center); Cross, P.L.; Gettemy, D.J.; Kokta, M.R. pp. 215-221 of Proceedings of the OSA on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

Concentration of the active atom as well as type and concentration of sensitizers can have a significant impact on the performance of a multiply doped Ho:YAG laser. Moreover, the temperature dependent performance depends on the concentrations of the various constituents of the laser rod. Performance of three laser rods, two sensitized with Tm and Cr and the third sensitized with Tm and Er, was measured as a function of temperature. Measured threshold correlates well with temperature dependent occupation factors while slope efficiency data correlates well with an up conversion process.

45069 Diode laser end-pumped neodymium lasers: The road to higher powers. Fields, R.A. (Aerospace Corp., Los Angeles, CA (USA). Electronics Research Lab.); Rose, T.S.; Innocenzi, M.E.; Yura, H.T.; Fincher, C.L. pp. 301-308 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

The authors have demonstrated that they believe to be the highest electrical efficiency (19%), optical efficiency 61%), and output power (1.22 W) from a diode pumped Nd:YVO_4 laser. The effects of mode size, thermal loading, and laser material on high power end pumping are discussed.

45070 Growth and characterization of $LiCaAlF_6:Cr^{3+}$ for solid state laser applications. Kway, W.L. (Colorado School of Mines, Golden, CO (USA). Research Inst.); Newkirk, H.W.; Chase, L.L. pp. 408-410 of Proceedings of the OSA conference on tunable solid state lasers: Volume 5. Shand, M.L.; Jenssen, H.P. Optical Society of America, Washington, DC (USA) (1989). (CONF-890532–: Optical Society of American (OSA) topical meeting on tunable solid state lasers, North Falmouth, MA (USA), 1-3 May 1989).

$LiCaAlF_6:Cr^{3+}$ single crystals doped with 3% CrF_3 (Cr:LiCAF) have been grown by the Czochralski (CZ) technique in dimensions up to 1 in. diameter and 3 in. in length. In this paper, the authors address several important criteria related to the growth and characterization of this material. Cr:LiCAF has recently been demonstrated to laser efficiently when using laser pumping of small crystals. In this work the authors report on efforts to grow large single crystals to be used for the flashlamp-pumped configuration.

45071 Photon-assisted resonant tunneling through a double-barrier structure for infrared radiation detection. Cai,

W. (Department of Physics, City College of the City University of New York, New York, NY (USA)); Zheng, T.F.; Hu, P.; Lax, M.; Shum, K.; Alfano, R.R. *Physical Review Letters (USA)*, 65(1): 104-107 (2 Jul 1990).

A Green's-function approach is employed to calculate the electron tunneling through a double-barrier device for infrared-radiation detection. Electrons photoexcited by an ir beam undergo transitions to a resonant channel, so that the transmission coefficient for tunneling substantially increases by several orders of magnitude compared with the dark state. This photon-induced resonant tunneling can be switched and controlled by a change of the applied static voltage. Such a system is ideal for ir photodetectors.

45072 Acoustic instability induced in compressible, transparent fluids by electrostrictive effects. Chitanvis, S.M. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)). *Optics Letters (USA)*, 15(14): 763-765 (15 Jul 1990).

If the electromagnetic energy density of the incident high-energy laser beam is sufficiently high, an instability is induced in an irradiated, compressible fluid by electrostrictive effects. The physical basis of this instability is that a dielectric fluid flows toward a region of high-energy density, countering the usual tendency of a fluid to flow from a region of higher to lower pressure. An observable signature of this instability is calculated. This instability can occur in water droplets that are irradiated by a high-energy laser beam.

45073 Vanadium-pumped titanium x-ray laser. Nilsen, J. (Lawrence Livermore National Laboratory, Livermore, California 94550 (USA)). *Optics Letters (USA)*, 15(14): 798-800 (15 Jul 1990). DOE Contract W-7405-ENG-48.

A new laboratory x-ray laser is described that is resonantly photopumped by two $3d \rightarrow 2p$ emission lines in fluorinelike vanadium ($Z = 23$) and lases on several $3p \rightarrow 3s$ transitions in neonlike titanium ($Z = 22$). Calculations show that five of the laser lines have gains greater than 5 cm^{-1} for reasonable values of the pump lines, with the shortest wavelength of the five being at 32.65 nm.

45074 Anticipated improvement in laser beam uniformity using distributed phase plates with quasirandom patterns. Epstein, R. (Laboratory for Laser Energetics, University of Rochester, Rochester, New York 14623-1299 (USA)); Skupsky, S. *Journal of Applied Physics (USA)*, 68(3): 924-931 (1 Aug 1990). DOE Contract FC03-85DP40200.

The uniformity of focused laser beams, that has been modified with randomly phased distributed phase plates [C. B. Burckhardt, Appl. Opt. **9**, 695 (1970); Kato and Mima, Appl. Phys. B **29**, 186 (1982); Kato *et al.*, Phys. Rev. Lett. **53**, 1057 (1984); LLE Rev. **33**, 1 (1987)], can be improved further by constructing patterns of phase elements which minimize phase correlations over small separations. Long-wavelength nonuniformities in the intensity distribution, which are relatively difficult to overcome in the target by thermal smoothing and in the laser by, e.g., spectral dispersion [Skupsky *et al.*, J. Appl. Phys. **66**, 3456 (1989); LLE Rev. **36**, 158 (1989); **37**, 29 (1989); **37**, 40 (1989)], result largely from short-range phase correlations between phase plate elements. To reduce the long-wavelength structure, we have constructed phase patterns with smaller short-range correlations than would occur randomly. Calculations show that long-wavelength nonuniformities in single-beam intensity patterns can be reduced with these masks when the intrinsic phase error of the beam falls below certain limits. We show the effect of this improvement on uniformity for spherical irradiation by a multibeam system.

45075 Strong radiation guiding in a Raman free-electron laser under space-charge neutralization. Tripathi, V.K. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742-3511 (USA)); Liu, C.S. *Physics of Fluids B (USA)*, 2(8): 1949-1951 (Aug 1990). DOE Contract FG05-86ER53221.

A high-current relativistic electron beam propagating through a plasma causes local depression in plasma electron density to attain charge neutralization. The plasma duct thus formed guides and localizes high-frequency radiation when the beam current $I_b \gtrsim mc^3/e \approx 17$ K A. This scheme of plasma guiding of a free-electron laser leads to strong localization of the radiation wave, and to a much higher growth rate for free-electron lasers.

45076 Studies of the electrical and interface properties of the metal contacts to $CuInSe_2$ single crystals. Abou-Elfotouh, F.A. (Solar Energy Research Institute, Golden, Colorado 80401 (USA)); Kazmerski, L.L.; Matson, R.J.; Dunlavy, D.J.; Coutts, T.J. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3251-3254 (Jul 1990).

The electrical behavior of the metal contacts and ITO and CdS junctions to single crystals of $CuInSe_2$ has been studied using *I–V* and electron beam induced current measurements, then correlated to the chemical composition and intrinsic defect states in the semiconductor. The results have indicated that the contact resistance, junction characteristics, and crystalline order of surfaces are controlled mainly by the type and relative concentration of the intrinsic defect states dominating the copper-indium-deselenide material; these states are very sensitive to heat treatments and surface preparation procedures. Correlation between the behavior of different samples (polycrystalline thin films or single crystals) should be based upon similarities in the type and relative concentration of the chemical composition.

45077 Room-temperature, laser diode-pumped, Q-switched, 2 micron, thulium-doped, solid state laser. Esterowitz, L.; Stoneman, R.C. To Department of the Navy, Washington, DC. USA Patent Application 7-501,461. 30 Mar 1990. 18p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

A room-temperature, laser-pumped, Q-switched, thulium-doped, solid state laser for producing pulses of laser emission at substantially 2 microns is disclosed. In a preferred embodiment, the laser comprises: a laser cavity defined by first and second reflective path elements opposing each other on a common axis to form a reflective path there between; a laser crystal disposed in the laser cavity, the laser crystal having a host material doped with an amount of thulium activator ions sufficient to produce a laser emission at substantially 2 microns from the 3F4 to 3H6 laser transition in the thulium activator ions when the laser crystal is enabled and is pumped by a CW pump beam at a preselected wavelength; a pump laser for pumping the laser crystal with the CW pump beam at the preselected wavelength; and a Q-switch disposed in the laser cavity between the laser crystal and the second reflective element for periodically enabling the laser crystal to produce a pulsed laser emission at substantially 2 microns when the crystal is also pumped by the CW pump beam.

45078 Precision alignment device. Jones, N.E. To Dept. of Energy, Washington, DC (USA). USA Patent 4,907,881/A/. 13 Mar 1990. Filed date 10 Mar 1988. USA Patent Application 7-166,582. Int. Cl. G01B 11/26. 10p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an apparatus for providing automatic alignment of beam devices having an associated structure for directing, collimating, focusing, reflecting, or otherwise modifying the main beam. A reference laser is attached to the structure enclosing the main beam producing apparatus and produces a reference beam substantially parallel to the main beam. Detector modules containing optical switching devices and optical detectors are positioned in the path of the reference beam and are effective to produce an electrical output indicative of the alignment of the main beam. This electrical output drives servo-motor operated adjustment screws to adjust the position of elements of the structure associated with the main beam to maintain alignment of the main beam.

45079 Birefringent corrugated waveguide. Moeller, C.P. To Dept. of Energy, Washington, DC (USA). USA Patent 4,906,951/A/. 6 Mar 1990. Filed date 15 Feb 1989. USA Patent Application 7-310,555. Int. Cl. H01P 1/165. 8p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a corrugated waveguide having a circular bore and noncircularly symmetric corrugations, and preferably elliptical corrugations which provides birefringence for rotation of polarization in the HE_{11} mode. The corrugated waveguide may be fabricated by cutting circular grooves on a lathe in a cylindrical tube or rod of aluminum of a diameter suitable for the bore of the waveguide, and then cutting an approximation to ellipses for the

corrugations using a cutting radius R_0 from the bore axis that is greater than the bore radius, and then making two circular cuts using a radius R_1 less than R_0 at centers + b and – B from the axis of the waveguide bore. Alternatively, stock for the mandrel may be formed with an elliptical transverse cross section, and then only the circular grooves need be cut on a lathe, leaving elliptical corrugations between the grooves. In either case, the mandrel is first electroplated and then dissolved leaving a corrugated waveguide with noncircularly symmetric corrugations. A transition waveguide is used that gradually varies from circular to elliptical corrugations to couple a circularly corrugated waveguide to an elliptically corrugated waveguide.

45080 UHF FM receiver having improved frequency stability and low RFI emission. Lupinetti, F. To Dept. of Energy, Washington, DC (USA). USA Patent 4,905,087/A/. 27 Feb 1990. Filed date 29 Aug 1988. USA Patent Application 7-237,191. Int. Cl. H04N 5/455. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a UHF receiver which converts UHF modulated carrier signals to baseband video signals without any heterodyne or frequency conversion stages. A bandpass filter having a fixed frequency first filters the signals. A low noise amplifier amplifies the filtered signal and applies the signal through further amplification stages to a limited FM demodulator circuit. The UHF signal is directly converted to a baseband video signal. The baseband video signal is clamped by a clamping circuit before driving a monitor. Frequency stability for the receivers is at a theoretical maximum, and interference to adjacent receivers is eliminated due to the absence of a local oscillator.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 45687, 45898, 45912

45081 (GSI–89-10) **Proceedings of the workshop on crystalline ion beams.** Hasse, R.W.; Hofmann, I.; Liesen, D. (eds.). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. 339p. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The workshop consisted of mainly invited and some contributed papers. More informal discussions took place in three working groups on the following topics: beam cooling techniques; diagnostics of crystalline beams; storage rings for crystalline beams. The present volume collects all papers as well as the summaries of the working groups. See hints under the relevant topics. (orig./HSI).

4301 Design, Development, and Operation

Refer also to citation(s) 45012, 45723, 45918, 45924

45082 (AD-A–221740/4/XAB) **Recirculating electrostatic accelerators. Technical report No. 51, 1 October 1984-30 September 1985.** Elias, L.R.; Ramian, G. California Univ., Santa Barbara, CA (USA). Quantum Inst. 30 Sep 1985. 6p. Source: NTIS, PC A02/MF A01.

A 3 MeV electrostatic accelerator has been modified for high electron current operation using beam recovery. In a simple configuration, a maximum of 99.4% of a 1.25 Ampere electron beam has been recovered. In a more complex beam transport system that includes a permanent magnet undulator as much as 95% of the beam has been recovered. These devices are ideally suited to drive efficient free-electron lasers. Beam quality and beam recovery measurements are presented here.

45083 (AD-A–221755/2/XAB) **Stability regimes in a helical quadrupole focusing accelerator - theory and simulation. Memorandum report.** Krall, J.; Tang, C.M.; Joyce, G.; Sprangle, P. Naval Research Lab., Washington, DC (USA). 4 May 1990. 28p. (NRL-MR–6636). Source: NTIS, PC A03/MF A01.

The inclusion of helical quadrupole (stellarator) and axial guide fields in high current spiral line or recirculating accelerator configurations provides a high tolerance to energy mismatch and confines the beam against space charge forces. In such a configuration the electron beam can interact with the external fields and with electromagnetic waveguide modes such that the beam centroid can be (1) orbit unstable independent of the waveguide modes, (2) three-wave unstable or (3) fully stable. The various stability conditions are presented in the limit of zero beam current. These stability conditions are found to be good predictors of particle simulation results, with minor departures being observed at high current. Linearly unstable modes, obtained via numerical solutions of the dispersion relation, were observed in each simulation. Nonlinear behavior, such as mode saturation in some regimes, was also observed.

45084 (BNL–44953) **Low energy antiproton possibilities at the AGS.** Lee, Y.Y. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900766–1: 1. biennial conference on low energy antiproton physics, Stockholm (Sweden), 2-6 Jul 1990). Order Number DE90016316. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The technical feasibility of creating a pure antiproton beam at the AGS has been studied. The scheme involves an antiproton target station and transport back to the Booster synchrotron, which acts as both a purifier and accelerator/decelerator. This proposal would be very attractive to the user community since this operation could run parasitically (transparently) to the AGS operating modes. The energy range of antiprotons can be as low as 2 MeV to as high as 5 GeV. The intensity of the beam is estimated to be 7×10^7/sec above 2.5 GeV/c and 4×10^4/sec at 200 MeV/c.

45085 (DOE/ER–0464P) **Report of the 1990 HEPAP [High Energy Physics Advisory Panel] subpanel on SSC [Superconducting Super Collider] cost estimate oversight.** High Energy Physics Advisory Panel (USA). Subpanel on SSC Cost Estimate Oversight. Jul 1990. 23p. Sponsored by U.S. DOE Energy Research. Order Number DE90014828. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the request of the Office of Energy Research, the High Energy Physics Advisory Panel (HEPAP) established a subpanel to conduct an independent assessment of the Superconducting Super Collider (SSC). This assessment was conducted before, during, and after the DOE's in-depth assessment of the entire project in June 1990. In summary, the subpanel believes that to reduce risk, 6 to 12 months should be added to the schedule; the project should be rephased; and additional funding planned to bring the total project cost, including contingency and escalation, to about $8.6 billion. In addition, we suggest adding another $300 million to the detector budget to allow for two large detectors and, therefore, a more balanced experimental program initially.

45086 (DOE/ER/13491–424) **The Kansas State atomic collision physics facility dedicated to the studies of atomic interactions of highly charged, low and medium energy ions.** Stoeckli, M.P.; Carnes, K.; Cocke, C.L.; Curnutte, B.; Gray, T.J.; Hagmann, S.; Legg, J.C.; Richard, P. Kansas State Univ., Manhattan, KS (USA). J.R. MacDonald Lab. [1988]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13491. (CONF-8810289–2: 11. All-Union conference on charged particle accelerators, Dubna (USSR), 25-27 Oct 1988). Order Number DE90015651. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We discuss our facility at Kansas State University, which is perfectly suited for studies of atomic collisions involving highly charged, low and medium energy ions. It should be fully operational by next year and will be operated as a user facility. We encourage collaborations with in-house researchers, because it facilitates communications and experiments. 13 refs., 3 figs.

45087 (ENEA-RT-TIB–89-34) **The ENEA racetrack microtron: Design criteria and status.** Picardi, L.; Ronsivalle, C. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. Nov 1989. 18p. (RT/TIB–89-34). Order Number DE90514483. Source: NTIS (US Sales Only), PC A03/MF A01.

Submitted to Nuovo Cimento D.

A variable energy (20-100 MeV) racetrack microtron (RTM) is under construction at ENEA (Italian Commission for Alternative

Energy Sources) Accelerator Laboratories, Frascati, Italy. This machine, designed to serve as a driver for a free electron laser (FEL) source (20-30 MeV) in the infrared region, has other considerably interesting applications. All the components have been constructed with the exception of the extraction magnets. Successful tests have been made on the two main magnets and injection gun. The RF system can supply 5 MW(e), 5 micro s peak power to the 2998 MHz, 5 MeV linac, which has already been tested at low power. In this paper, we report a comparison between the computations and measurements performed up to the present stage of the project.

45088 (GSI–89-10, pp. 2-32) **Order in cold ionic systems: Dynamic effects.** Schiffer, J.P. (Argonne National Lab., IL (USA)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. Contract W-31-109-Eng-38. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The present state and recent developments in momecular dynamics calculations modeling cooled heavy-ion beams are summarized. First, a frame of reference is established, summarizing what has happened in the past; then the properties of model systems of cold ions studied in molecular dynamics calculations are reviewed, with static boundary conditions with which an ordered state is revealed; finally, more recent results on such modelling, adding the complications in the (time-dependent) boundary conditions that begin to approach real storage rings (ion traps) are reported. (orig.).

45089 (GSI–89-10, pp. 33-42) **The cylindrically confined Coulomb lattice.** Hasse, R.W. (Gesellschaft fuer Schwerionenforschung, GSI, Darmstadt (Germany, F.R.)); Schiffer, J.P. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The structure of cold ions confined in a cylindrically symmetric static potential is explored by means of Molecular Dynamics calculations, as an approximation to a cooled ion beam in a storage ring. For low densities the ions arrange in a linear string along the axis of symmetry; above a critical density first a zigzag pattern appears, then a helix with increasing number of particles per turn, then a tetrahedral structure of pairs of ions. With increasing density the average minimum distance between particles becomes constant. Above another linear density, ions begin to appear on the axis inside the shell formed by the tetrahedra and helices, with the number of shells increasing with linear particle density. On the surface of the cylindrical shells the particles form equilateral triangles arranged in a hexagonal structure. For the innermost helices the dependence of shell radii and of angles between particles are compared to analytic model calculations: at low densities the energies of these configurations are minimized with respect to the degrees of freedom, while for larger densities approximate geometrical models are used. (orig.).

45090 (GSI–89-10, pp. 43-63) **Simple treatment of ordered beams.** Habs, D. (MPI fuer Kernphysik, Heidelberg (Germany, F.R.)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The properties of one-dimensional harmonic and Coulomb chains of particles are discussed. The eigenvalues and eigenmodes of helical beam crystals in a simple radial harmonic focussing field have been calculated by solving the secular equations. Low intensity beams have helical configurations which are shown to be stable. The dynamic structure factor can be calculated for conditions accessible in an experiment. The nonequilibrium order with sliding one-dimensional chains is discussed in terms of strongly sheared viscous liquid beams by carrying over the results from real liquids. (orig.).

45091 (GSI–89-10, pp. 64-72) **Speculations about condensation in particle beams.** Mills, F.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

Recently there has been interest shown in the possibility that stored cooled beams might exist in a crystalline state. In this paper, the physical background of this idea is discussed briefly, and a system is proposed in which this state might be observed. The principal problems which are addressed are the storage ring lattice and the cooling systems. (orig.).

45092 (GSI–89-10, pp. 108-132) **Limitations and instabilities in cooled beams.** Moehl, D. (CERN, Geneva (Switzerland)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The standard theory of intensity limitations is applied in a simplified way to beams subject to cooling. The aim is to get some idea as to whether densities might be obtainable where beam crystallization - as first discussed by the Novosibirsk Group - could occur. We conclude that present day cooling rings encounter limits at densities many orders of magnitude below the critical value where three-dimensional ordering can set in. One-dimensional ordering - where particles line up in a string rather than in a 3D-lattice structure - might perhaps be possible in low-intensity ($N \leq 10^6$) beams subject to ultra strong cooling. Heavy ions do not seem to be much more susceptible to crystallization than light ions or protons. (orig.).

45093 (GSI–89-10, pp. 133-139) **The suppression of transverse instabilities caused by trapped ions in the AA by shaking of anti p beam.** Orlov, Y. (CERN, Geneva (Switzerland)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The author explains theoretically the application of shaking of the anti p beam to the suppression of diffusion effects produced by nonlinear resonances between the anti p beam and ions in the CERN antiproton cooling ring AA. (HSI).

45094 (GSI–89-10, pp. 157-170) **Schottky noise. What can we observe?.** Baird, S. (CERN, PS Div., Geneve (Switzerland)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

This paper gives a very simplified outline of Schottky noise in stored particle beams, the different kinds of signals which can be observed and some phenomena, which can disrupt the observed signals. (orig.).

45095 (JAERI-M–90-025, pp. 179-188) **Development plan in JAERI for high intensity proton linear accelerator.** Mizumoto, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Sugimoto, M.; Okumura, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

A high intensity proton linear accelerator has been recently holding an considerable attention for the future developments in nuclear technology. A proposal to incinerate radio active nuclear wastes (in particular, transuranium TRU nuclides) has been made by using spallation reaction with high energy proton beam. This spallation reaction will also produce intense secondary neutron, muon and pion beams. Various applied researches including nuclear data measurements will be carried out using these secondary

beams. An accelerator, which the Japan Atomic Energy Research Institute (JAERI) has been proposing to construct as a long term research project, will be described in this report. (author).

45096 (KEK–89-12, pp. 1-8) **The electron stretcher accelerator ELSA.** Husmann, D. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

The electron stretcher accelerator, ELSA, provides unpolarized and polarized electron beams at energies between 0.5 and 3.5 GeV at high duty factor up to 99%. ELSA partly can serve also as a synchrotron radiation source in the vacuum ultra violet and X-ray region. ELSA is a circular accelerator of 165 m circumference. The Bonn 2.5 GeV Electron Synchrotron, which came into operation in 1967, is used as injector. To achieve the above-mentioned features, ELSA is operated in three different modes. 'Stretcher mode' is used at energies between 0.5 and 2.0 GeV. For a beam energy above 2.0 GeV, ELSA is operated in the 'post acceleration mode'. Where it is operated as a dedicated 'synchrotron radiation source', electrons are accumulated up to a limit of about 50 mA at 3.5 GeV. Dipole fields to obtain a closed orbit and quadrupole fields to get beam focusing are realized with help of two kinds of magnets, namely dipoles and quadrupoles. This structure provides radiation damping of the horizontal betatron oscillation needed for bean storage. It also allows a wade range variation of the optical working point of the machine. The ring contains 12 sextupoles, in addition to 32 quadrupoles and 24 dipoles, for correction of the optics and for extraction purposes. (N.K.).

45097 (LA–11857-C) **Proceedings of the conference on computer codes and the linear accelerator community.** Cooper, R.K. (comp.). Los Alamos National Lab., NM (USA). Jul 1990. 531p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-900163–: Conference on computer codes and the linear accelerator community, Los Alamos, NM (USA), 22-25 Jan 1990). Order Number DE90014820. Source: NTIS, PC A22/MF A01; OSTI; INIS; GPO Dep.

The conference whose proceedings you are reading was envisioned as the second in a series, the first having been held in San Diego in January 1988. The intended participants were those people who are actively involved in writing and applying computer codes for the solution of problems related to the design and construction of linear accelerators. The first conference reviewed many of the codes both extant and under development. This second conference provided an opportunity to update the status of those codes, and to provide a forum in which emerging new 3D codes could be described and discussed. The afternoon poster session on the second day of the conference provided an opportunity for extended discussion. All in all, this conference was felt to be quite a useful interchange of ideas and developments in the field of 3D calculations, parallel computation, higher-order optics calculations, and code documentation and maintenance for the linear accelerator community. A third conference is planned.

45098 (LBL–29228) **Review of ion accelerators.** Alonso, J. Lawrence Berkeley Lab., CA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900603–31: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE90015430. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The field of ion acceleration to higher energies has grown rapidly in the last years. Many new facilities as well as substantial upgrades of existing facilities have extended the mass and energy range of available beams. Perhaps more significant for the long-term development of the field has been the expansion in the applications of these beams, and the building of facilities dedicated to areas outside of nuclear physics. This review will cover many of these new developments. Emphasis will be placed on accelerators with final energies above 50 MeV/amu. Facilities such as superconducting cyclotrons and storage rings are adequately covered in other review papers, and so will not be covered here.

45099 (LBL–29229) **Accelerators for research and applications.** Alonso, J.R. Lawrence Berkeley Lab., CA (USA). Jun 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9008129–2: 11. biennial conference on chemical education, Atlanta, GA (USA), 5-9 Aug 1990). Order Number DE90015315. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The newest particle accelerators are almost always built for extending the frontiers of research, at the cutting edge of science and technology. Once these machines are operating and these technologies mature, new applications are always found, many of which touch our lives in profound ways. The evolution of accelerator technologies will be discussed, with descriptions of accelerator types and characteristics. The wide range of applications of accelerators will be discussed, in fields such as nuclear science, medicine, astrophysics and space-sciences, power generation, airport security, materials processing and microcircuit fabrication. 13 figs.

45100 (LBL–29256) **Future physics with a proposed radioactive beam facility in the United States.** Nitschke, J.M. Lawrence Berkeley Lab., CA (USA). Jun 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900450–8: Nuclear structure in the '90's, Oak Ridge, TN (USA), 23-27 Apr 1990). Order Number DE90015639. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A brief overview of the physics at a proposed radioactive beam facility or ISOSPIN LABORATORY is presented. Its impact on future directions in nuclear structure, nuclei far from stability, reaction physics, nuclear astrophysics, and several applied fields is pointed out. Of particular interest are neutron rich beams. Radioactive beams with energies on the order of ~10 MeV/nucleon or less are emphasized rather than the more energetic beams obtainable through projectile fragmentation. A concept of a high-intensity radioactive beam facility based on the post-acceleration of radioactive ions from an isotope-separator linked to a high-current, high-energy, light ion accelerator is discussed. 21 refs., 1 figs.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 45083, 45138, 46221, 46247

45101 (BNL–44886) **A partial snake for the AGS.** Ratner, L.G. Brookhaven National Lab., Upton, NY (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900924–1: 9. international symposium on high energy spin-physics, Bonn (Germany, F.R.), 10-15 Sep 1990). Order Number DE90015683. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Based on snake experiments at the Indian University Cyclotron Facility and computer simulations at Brookhaven National Laboratory, as well as the conclusions of a BNL mini-workshop, we feel that a partial Siberian snake is a practical device for the AGS. It is anticipated that such a device could reduce the polarized beam tune-up time from 2–3 weeks to 2–3 days.

45102 (BNL–44904) **Transition crossing in the main injector.** Wei, J. Brookhaven National Lab., Upton, NY (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9006259–2: Fermilab III instabilities workshop, Batavia, IL (USA), 25-29 Jun 1990). Order Number DE90016326. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report summarizes the study of various longitudinal problems pertaining to the transition-energy crossing in the proposed Fermi Lab Main Injector. The theory indicates that the beam loss and bunch-area growth are mainly caused by the chromatic nonlinear effect, which is enhanced by the space-charge force near transition. Computer simulation using the program TIBETAN shows that a "γ_T jump" of about 1.5 unit within 1 ms is adequate to achieve a "clean" crossing in the currently proposed h=588 scenario. 19 refs., 4 figs.

45103 (FNAL/C–90/140) **Numerical modeling of time domain 3-D problems in accelerator physics.** Harfoush, F.A.; Jurgens, T.G. Fermi National Accelerator Lab., Batavia, IL (USA).

Jun 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900603–32: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE90015625. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Time domain analysis is relevant in particle accelerators to study the electromagnetic field interaction of a moving source particle on a lagging test particle as the particles pass an accelerating cavity or some other structure. These fields are called wake fields. The travelling beam inside a beam pipe may undergo more complicated interactions with its environment due to the presence of other irregularities like wires, thin slots, joints and other types of obstacles. Analytical solutions of such problems is impossible and one has to resort to a numerical method. In this paper we present results of our first attempt to model these problems in 3-D using our finite difference time domain (FDTD) code. 10 refs., 9 figs.

45104 (LAL–89-28) **Increase of emittance by inverse multiple Touschek effect in a single bunch of charged accelerated particles.** Perez, J.; Jorba, Y. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Sep 1989. 13p. Order Number DE90514610. Source: NTIS (US Sales Only), PC A03/MF A01.

Coulomb scattering of the longitudinal momentum distribution of particles in an accelerated bunch leads to the creation of a transverse emittance which adds to the natural emittance. This process has been calculated for high energy linacs used in high energy e^+e^- linear colliders. At beam energies of 500 GeV to 1 TeV, it has been found that the effect is weak.

45105 (LAL-RT–89-05) **Possibility to measure very small spot sizes using gas ionization at future linear colliders.** Buon, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Aug 1989. 23p. (CONF-890803–: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90514616. Source: NTIS (US Sales Only), PC A03/MF A01.

In the case of the final focus test beam (FFTB), proposed at SLAC, transverse dimensions of an electron beam could be measured at the focus by ionization of a low-density gas target. On the one hand, collecting and measuring the number of ions, produced in a gas target of heavy atoms (e.g. Xenon), would allow to obtain the transverse beam cross-section. On the other hand, with a gas of light atoms (e.g. Hydrogen), measuring the angular distribution of the ions, trapped and kicked by the electron beam, would allow to obtain the flatness of the beam. Unfortunately, these methods can hardly be extrapolated to the case of future linear colliders presently studied (TLC, CLIC,...). The beam space charge field would be so large (larger than 10^9 V/cm) that atoms would be ionized by field emission in a wide region around the beam. The ion parameters (number, velocity,...) are not simply related to the transverse beam dimensions.

45106 (LBL–28570) **The ion-channel laser.** Whittum, D.H. (Lawrence Berkeley Lab., CA (USA)); Sessler, A.M.; Dawson, J.M. Lawrence Berkeley Lab., CA (USA). Jan 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098 ;FG03-87ER13752. Order Number DE90016646. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A relativistic electron beam propagating through a plasma in the ion-focused regime exhibits an electromagnetic instability at a resonant frequency $\omega \sim 2\gamma^2 \omega_\beta$. Growth is enhanced by optical guiding in the ion channel, which acts as dielectric waveguide, with fiber parameter $V \sim 2 (I/I_A)^{1/2}$. A 1-D theory for such an "ion-channel laser" is formulated, scaling laws are derived and numerical examples are given. Possible experimental evidence is noted. 23 refs., 1 fig., 1 tab.

45107 (LBL–28881) **COSY INFINITY reference manual.** Berz, M. Lawrence Berkeley Lab., CA (USA). Jul 1990. 36p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90014892. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is a reference manual for the arbitrary order particle optics and beam dynamics code COSY INFINITY. It is current as of June 28, 1990. COSY INFINITY is a code to study and design particle optical systems, including beamlines, spectrometers, and particle accelerators. At its core it is using differential algebraic (DA) methods, which allow a very systematic and simple calculation of high order effects. At the same time, it allows the computation of dependences on system parameters, which is often interesting in its own right and can also be used for fitting. COSY INFINITY has a full structured object oriented language environment. This provides a simple interface for the casual user. At the same time, it offers the demanding user a very flexible and powerful tool for the study and design of systems, and more generally, the utilization of DA methods. The power and generality of the environment is perhaps best demonstrated by the fact that the physics routines of COSY INFINITY are written in its own input language and are very compact. The approach also considerably facilitates the implementation of new features because they are incorporated with the same commands that are used for design and study. 26 refs.

45108 (LBL–29148) **Beam impedance of a split cylinder.** Lambertson, G. Lawrence Berkeley Lab., CA (USA). Apr 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016645. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A common geometry for position electrodes at moderately low frequencies is the capacitive pickup consisting of a diagonally- divided cylinder that encloses the beam trajectory. For the simplified system here, a relatively direct approach will given the longitudinal and transverse beam impedances ($Z_\parallel$and $Z_\perp$) at low frequencies. This paper discusses the determination of this impedance.

45109 (SAND–90-1466C) **The 3D, electromagnetic, particle-in-cell code, QUICKSILVER.** Seidel, D.B.; Kiefer, M.L.; Coats, R.S.; Pointon, T.D.; Quintenz, J.P.; Johnson, W.A. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009102–1: 2. international computational physics conference and Europhysics conference on computational physics, Amsterdam (Netherlands), 10-13 Sep 1990). Order Number DE90016221. Source: NTIS, PC A02/MF A01 - OSTI.

Charged-particle simulations in three dimensions are now performed routinely in the Pulsed Power Sciences Directorate at Sandia with the QUICKSILVER suite of codes. QUICKSILVER is a multitasked, finite-difference, three-dimensional, fully relativistic, electromagnetic, particle-in-cell code developed at Sandia. It is targeted for use on current and near-term supercomputers, such as the Cray Y-MP/864 or the Cray X-MP/416, which are characterized by large, shared central memories and multiple processors. QUICKSILVER has already been used to simulate ion diodes, magnetically insulated transmission lines, microwave devices, and electron beam propagation. Before describing the suite in detail, it is worthwhile to highlight some salient architectural features of the QUICKSILVER simulation code. All grid-related quantities (electromagnetic fields and current density, for example) are stored in central memory and particle information may be stored out of memory if there is not sufficient central memory. In order to minimize the use of central memory, large conductor volumes in which fields are always zero must not be stored. This necessitates constructing the simulation region from "blocks" logically connected along arbitrary planes. The overhead required to accomplish this block connection in the field-solving routines uses a very small percentage of the total processing time. After the grid-related arrays have been allocated in memory, additional central memory is used to cache particle information. When this cache is full, it is necessary to shuffle particle information in and out of the memory cache and onto disk or other out-of-memory storage. 8 refs.

45110 (SSC–78) **Lie algebraic maps and invariants produced by tracking codes.** Forest, E. Lawrence Berkeley Lab., CA (USA). SSC Central Design Group. Jul 1986. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-89ER40486. Order Number DE90015210. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We derive the tools necessary for the extraction of a map from standard tracking programs using multipole kicks. Our results applied to programs using approximate Hamiltonians (PATRICIA, RACETRACK) or to the more rigorous symplectic integrators. As an example of a symplectic integrator, we chose the kick code

TEAPOT for its simplicity. Our results are nevertheless general because Neri has shown that symplectic integrators are in fact kick codes. Finally, we give the general formulae for geometric invariants which are quartic extensions of the usual Courant-Snyder invariants. 20 ref., 2 figs., 2 tabs.

45111 (SSC–138) **Canonical integrators as tracking codes (or how to integrate perturbation theory with tracking).** Forest, E. Lawrence Berkeley Lab., CA (USA). SSC Central Design Group. Sep 1987. 38p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-89ER40486. Order Number DE90015211. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses: the Hamiltonian of the combined sector bend; approximation maps and their representation; cononical integration techniques; and extraction of a consistent approximation map. (LSP)

45112 (UCRL-JC–104643) **Critical system issues and modeling requirements: The problem of beam energy sweep in an electron linear induction accelerator.** Turner, W.C.; Barrett, D.M.; Sampayan, S.E. Lawrence Livermore National Lab., CA (USA). 6 Aug 1990. 11p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Contract W31RPD-0-D4074. (CONF-900280–4: International workshop on magnetic pulse compression, Lake Tahoe, NV (USA), 12-14 Feb 1990). Order Number DE90015607. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we discuss system issues and modeling requirements within the context of energy sweep in an electron linear induction accelerator. When needed, particular parameter values are taken from the ETA-II linear induction accelerator at Lawrence Livermore National Laboratory. For this paper, the most important parameter is energy sweep during a pulse. It is important to have low energy sweep to satisfy the FEL resonance condition and to limit the beam corkscrew motion. It is desired to achieve $\Delta E/E = \pm 1\%$ for a 50-ns flattop whereas the present level of performance is $\Delta E/E = \pm 1\%$ in 10 ns. To improve this situation we will identify a number of areas in which modeling could help increase understanding and improve our ability to design linear induction accelerators.

4303 Auxiliaries and Components

Refer also to citation(s) 45055, 45087, 45777, 45893, 46240

45113 (BNL–44883) **Test modulator of AGS injection fast kicker.** Zhang, W.; Frey, W.W.; Soukas, A.V.; Zhang, S.Y.; Bunicci, J. Brookhaven National Lab., Upton, NY (USA). 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9006176–14: 19. power modulator symposium, San Diego, CA (USA), Jun 1990). Order Number DE90015684. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In this paper, a test modulator of the brookhaven AGS injection fast kicker is described. The AGS injection kicker is the complementary system to the AGS Booster extraction fast kicker. During the fourth batch transfer of the proton beam from the booster to AGS, the fall time of the AGS injection kicker has to be very fast (<140 ns), so that it does not appreciably deflect the first batch of injected protons that is circulating in the AGS. A test modulator was built, which consists of a PFN, a tail-biting section, and two thyratron switches. One thyratron switches the current to the load magnet, and another bites down the current at the end of the pulse. The load and circuit stray inductance is about 1.95 μH to 2.15 μH, and the required peak current is about 1000 Amp. The current pulse waveform, tested at half current level (500 amp), has a fast fall time as well as a fast rise time. The test results will be presented, and some technical difficulties will be discussed. 5 refs., 2 figs.

45114 (BNL–44884) **A PFN and transmission line simulation method for energy discharge systems.** Zhang, W.; Zhang, S.Y.; Soukes, A.V.; Frey, W.W. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9006176–13: 19. power modulator symposium, San Diego, CA (USA), Jun 1990). Order Number DE90015685. Source: NTIS, PC A02/MF A01 - OSTI.

This paper discusses an analysis and simulation algorithm for energy discharge systems consisting of a pulse forming network and a transmission line. The network formulation is represented in the state space form, and the analysis is based on the network eigen-system. The eigen-system is commonly used in the analysis of feedback control systems and electronic circuits. In an energy discharge network, the time response is governed by the system eigenvalues, their weights, and the initial states of the energy storage elements. Therefore, the eigen-system analysis can be applied to simulate the system time response. This method differs from the time difference equation step-iterative simulation in the following aspects. The accuracy of the simulation mainly relies on the eigen-system parameter evaluation. There is no cumulative time step iteration error. The simulation of the network response can be calculated from any moment of time, rather than from the initial time only. Since the method also provides information of the network characteristics, a model reduction can be readily obtained. The algorithm used in this paper can be easily realized by using commercially available MATRIX$_x$ or MATLAB programs. The user code program is reasonably simple and short. Some simulation examples will be presented. 8 refs., 7 figs.

45115 (BNL–44899) **Summary report on the transition crossing for MI.** Lee, S.Y. Brookhaven National Lab., Upton, NY (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9006259–1: Fermilab III instabilities workshop, Batavia, IL (USA), 25-29 Jun 1990). Order Number DE90016289. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The working group evaluates the problems related to transition energy crossing in the main injector for Tevatron at Fermilab. We found that the dominant problem arises from the nonlinear synchrotron motion and the microwave instability at the transition energy region. γ_T jump such that $\gamma_T \geq 1000\ \text{sec}^{-1}$ seems sufficient to obtain satisfactory transition energy crossing. To avoid longitudinal and transverse microwave instability, the maximum tolerable broad-band impedances can be derived. A possible imaginary γ_T lattice has also been studied. Some possible further studies are suggested. The main injector for Tevatron is designed to accelerator p or $\bar{p}$ from 8 GeV to 150 GeV. In a medium energy range accelerator, the transition energy crossing is an important, longitudinal beam-dynamical problem. There are two possible scenarios for the lattice design, i.e. transition crossing lattice or transitionless lattice. There are many accelerators such as AGS, CPS, JPS, Fermilab Booster, etc., where the transition energy crossing is a routine operation. To avoid longitudinal bunch dilution and beam loss, CPS and Fermilab Booster have γ_T jump schemes. The working group evaluates the problem related to the transition crossing in the main injector design. Here I summarize problems and solutions to the γ_T crossing. 10 refs.

45116 (BNL–44914) **The relativistic heavy ion collider at Brookhaven.** Ozaki, S. Brookhaven National Lab., Upton, NY (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–5: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90016319. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An overview of the RHIC project, recent project status, and R&D progress on its superconducting magnets are presented. Also discussed are the current construction and experimental programming plans at RHIC, including an announcement for a call for letters of intent for experiments. 6 figs., 1 tab.

45117 (FNAL-TM–1670) **Some estimation concerning crossing transition of the main injector.** Ng, King-Yuen. Fermi National Accelerator Lab., Batavia, IL (USA). Jun 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90014880. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We estimate some parameters pertaining to the transition crossing of the Main Injector. These include the nonadiabatic time, bunch length and bunch height at transition, the microwave growth across transition driven by a longitudinal impedance, and the parameters that govern the Umstaetter's and the Johnsen's effects. 9 refs., 1 tab.

45118 (FNAL-TM–1671) **SSC dipole magnet measurement and alignment using laser technology.** Lipski, A.; Carson, J.A.; Robotham, W.F. Fermi National Accelerator Lab., Batavia, IL (USA). Jun 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900348–13: 2. international industrial symposium on the super collider, Miami, FL (USA), 14-16 Mar 1990). Order Number DE90014881. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Advancing into the prototype production stage of the SSC dipole magnets has introduced the need for a reliable, readily available, accurate alignment measuring system which gives results in real time. Components and subassemblies such as the cold mass and vacuum vessel are being measured for various geometric conditions such as straightness and twist. Variations from nominal dimensions are also being recorded so they can be compensated for during the final assembly process. Precision laser alignment takes specific advantages of the greatest accuracy. When combined with an optically produced perpendicular plane, this results in a system of geometric references of unparalleled accuracy. This paper describes the geometric requirements for SSC dipole magnet components, sub and final assemblies as well as the use of laser technology for surveying as part of the assembly process.

45119 (FNAL-TM–1672) **Ternary superconductor "NbTiTa" for high field superfluid magnets.** McInturff, A.D. (Fermi National Accelerator Lab., Batavia, IL (USA)); Carson, J.; Larbalestier, D.; Lee, P.; McKinnel, J.; Kanithi, H.; McDonald, W.; O'Larey, P. Fermi National Accelerator Lab., Batavia, IL (USA). Jun 1990. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900436–1: International magnetics conference, Brighton (UK), 17-20 Apr 1990). Order Number DE90014879. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The possibility exists to obtain a higher 'Hc_2' upper critical field in the NbTi system which is normally limited by a spin-orbit coupling term. The introduction of scattering reduces this coupling. The spin-orbit scattering rate is proportional to Z^4 and therefore leads logically to the introduction of a high atomic number element which is more or less similar with respect to all of the other properties, i.e., Tc. Previous studies have shown Tantalum to be an excellent choice. The present work represents an attempt to obtain a high current density, high field ternary magnet conductor (Jc (10T, 2K, ρeff = 10^{-12} Ω-cm)) > 2000A/mm^2. This goal was met, but the conductor was clearly not optimized.

45120 (GSI–89-10, pp. 73-85) **Laser cooling and fast ion beams.** Bonderup, E. (Inst. of Physics, Aarhus Univ. (Denmark)); Jessen, P.; Moelmer, K.; Poulsen, O. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The cooling of ion beams by means of laser radiation is described. After a description of the theoretical foundations with special regards to the scattering force in a travelling plane wave and the dipole force in a standing plane wave experiments for the study of the cooling of a 100-keV Ne^+ beam and stimulated cooling of a fast beam are described. (HSI).

45121 (GSI–89-10, pp. 96-107) **A few results from electron cooling at LEAR.** Poth, H. (Kernforschungszentrum Karlsruhe, Inst. fuer Kernphysik (Germany, F.R.)); Schwab, W.; Seligmann, B.; Woertge, M.; Wolf, A. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

Electron cooling experiments were performed at the low energy antiproton ring LEAR at CERN with protons of 310, 200 and 137 MeV/c. Cooling times and frictional forces were measured under various experimental conditions and equilibrium beam sizes, divergences and momentum spreads were determined. A selection of experimental results are presented. (orig.).

45122 (GSI–89-10, pp. 289-293) **Laser cooling of $^9Be^+$ at the TSR.** Faulstich, A. (Physikalisches Inst., Heidelberg Univ. (Germany, F.R.)); Petrich, W.; Habs, D.; Neumann, R.; Schwalm, D.; Wolf, A.; Schroeder, S.; Huber, G.; Kuehl, T.; Marx, D. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The authors describe the laser cooling of the ^9Be beam of the Heidelberg Test Storage Ring (TSR) by which they hope to achieve an ion current of 5 μA with an initial momentum spread of $\Delta p/p=10^{-4}$. For the laser cooling the $2s^2S_{1/2}$-$2p^2P_{1/2}$ transition at 313 nm is used. (HSI).

45123 (GSI–89-10, pp. 299-306) **Towards laser cooling of a $^7Li^+$ ion beam.** Schroeder, S. (Inst. fuer Physik, Mainz Univ. (Germany, F.R.)); Gerhard, M.; Grieser, R.; Huber, G.; Klein, R.; Krieg, M.; Schmidt, N.; Dutta, M.; Kuehl, T.; Marx, D.; Faulstich, A.; Petrich, W.; Habs, D.; Neumann, R.; Schwalm, D.; Wolf, A. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

Laser induced fluorescence always transfers momentum to the absorbing atoms or ions. As a consequence, one can obtain a laser cooling force. Although very much restricted to the narrow laser resonance, it may exceed the electron cooling force. The lithium ion in its metastable $^3S_1$ state is one of several candidates for laser cooling of fast ion beams involving strong E1-transitions. In future experiments the $^7Li^+$ ion will also be used as a fast moving clock for testing the theory of special relativity. These experiments will be performed at the TSR and finally at the ESR in Darmstadt with much higher ion velocities. (orig.).

45124 (GSI–89-10, pp. 307-320) **On the combination of electron cooling and laser cooling.** Wolf, A. (Physikalisches Inst., Heidelberg Univ. (Germany, F.R.)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The possibility of using electron cooling in conjunction with laser cooling in a storage ring is discussed. Electron cooling enables low transverse emittances and a high density in laser-cooled ion beams. Basic parameters describing the cooling efficiency and the heating effect of both cooling methods are given and compared numerically for the conditions of the heavy ion Test Storage Ring (TSR) at the MPI in Heidelberg. The interference of both cooling methods appears to be weak. The use of electron cooling for providing the auxiliary acceleration necessary for laser cooling is considered. Estimates of the intrabeam scattering effect show that this process should be taken into account in connection with laser cooling even at relatively low ion densities. (orig.).

45125 (INS–817) **Exotic nuclei arena in Japanese Hadron Project.** Nomura, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1990. 10p. Order Number DE90513784. Source: NTIS (US Sales Only), PC A02/MF A01.

A description is given on the radioactive beam facility proposed as one of the research arenas in Japanese Hadron Project. The facility consists of a 1 GeV proton linac, an isotope separator on-line (ISOL) and a series of heavy-ion (HI) linacs. Various exotic nuclei produced by 1 GeV proton beam mainly via spallation processes of a thick target, are mass-separated by the ISOL with a high mass-resolving power and are injected into the HI linac with the energy of 1 keV/u. The acceleration is made in three stages using different types of linacs, i.e., split-coaxial RFQ. Interdigital-H, and Alvarez, the maximum energy in each stage being 0.17, 1.4 and 6.5 MeV/u, respectively. A few examples of scientific interests realized in this facility will be briefly discussed. (author).

45126 (INS–T–494) **Beam transport and injection system from the SF Cyclotron to the TARN II Synchrotron Cooler Ring.**

Soga, F. (and others); Noda, K.; Chida, K. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1990. 52p. Order Number DE90513786. Source: NTIS (US Sales Only), PC A04/MF A01.

Beam transport system from the INS-SF Cyclotron to 'TARN II' Synchrotron Cooler Ring was designed and constructed. In the present paper, design conception and details of components in the system as well as the experimental results of the performance are described. (author).

45127 (JAERI-M–90-025, pp. 189-207) **Automation of neutron scattering measurements at JAERI TANDEM.** Sugimoto, Masayoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The automation control system to set up the experimental apparatus and to manage acquisition and processing of the measured data is under development. The heart of this system consists of two personal computers dedicated to the equipment control and the data acquisition, respectively. The design concept is overviewed and the proposed user interface is described. The possibility for other applications is also discussed. (author).

45128 (JAERI-M–90-025, pp. 383-392) **Application of post acceleration beam chopper for neutron emission cross section measurements.** Baba, M. (Tohoku Univ., Sendai (Japan). Faculty of Engineering); Matsuyama, S.; Fujisawa, M.; Iwasaki, T.; Iwasaki, S.; Sakamoto, R. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

A post acceleration beam chopping system was newly installed for Tohoku University 4.5MV Dynamitron accelerator to reduce the pulsed beam duration and has been applied successfully for improvement of energy resolution in fast neutron time-of-flight experiments. Using the chopper, new measurements were carried out for double-differential neutron emission cross sections of ^{12}C and ^{6}Li for 14 MeV incident energy. (author).

45129 (KEK–89-10) **Future prospects for studies in the VUV-SX region.** Tanaka, Kenichiro; Kitajima, Yoshinori (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. 118p. (In Japanese). Order Number DE90513916. Source: NTIS (US Sales Only), PC A06/MF A01.

This book carries papers presented at a workshop 'Future Prospects for Studies in the VUV-SX Region' held on March 22 and 23, 1989. The workshop focussed particularly on the promotion of research in the VUV and soft X-ray regions. Three sessions were held: Session 1 for studies in peripheral areas, Session 2 for theoretical studies, and Session 3 for recent developments. Session 1 covered five studies: 'Laser Spectroscopy: High-Resolution Observation of Highly Electronically Excited Gaseous Molecule', 'High-Resolution Electron Spectroscopy: Surface Phonon Spectroscopy', 'Experimental Study on Atoms and Molecules through Ion Trap', 'Basic Mechanism of Photo-Induced CVD', and 'Application of Circularly Polarized Light'. Session 2 covered five studies: 'Electronic State of High Tc Superconducting Oxide', 'Surface Condition and Electronic State', 'XES and XAS Study of Rare Earth Compound', 'Resonance Photoelectric Spectroscopy on Strongly Correlated Electronic System', and 'Circularly Polarized Light and Atomic Process in Soft X-Ray Region'. Session 3 covered six studies: 'Prospects of Application of Supercritical Liquid to Research on Physical Characteristics', 'Application of Orbit Radiation to Polarization Spectroscopy', 'XES Research for La Compounds', 'Characteristics of Ultra-Fine Particles', 'Surface Study by Angular-Resolution Photoelectric Spectroscopy', and 'EXAFS Study of Light Element'. (N.K.).

45130 (KEK–89-12, pp. 35-45) **Possibility of slow beam extraction at HISOR synchrotron.** Sakaguchi, Atsushi (Hiroshima Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

In a plan for HiSOR facility at Hiroshima University, electrons will be accelerated by a linac and a synchrotron up to 1.5 GeV, and injected to a storage ring to provide synchrotron radiation. The injection will take only about one hour in a day, so there will be enough room for applying the electron beam from HiSOR synchrotron to experiments in nuclear physics, atomic physics, etc. For these experiments, electron beam will be extracted by a method with high duty factor and high efficiency. The extraction may be accomplished by resonant slow beam extraction. One of the best ways to extract electron beam is to avoid extraction of electrons with small emittance. This can be achieved by extracting electrons in the tail of the emittance distribution where the electrons have an emittance much larger than the average value, or by enlarging the beam emittance after radiation damping. A slow extraction scheme is proposed to accomplish continuous beam spills of a few second duration. To obtain a beam of constant current, it is necessary to establish feedback to the sextupole magnet strength and/or the betatron tune. Enlarged beam emittance may be achieved through RF knock out or anti-damping. Anti-damping will presumably be feasible in the HiSOR synchrotron. Test experiments are currently in progress to confirm these methods. (N.K.).

45131 (KEK–89-12, pp. 93-99) **Polarization experiments with electron accelerators.** Tamae, Tadaaki (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (In Japanese). (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

There has been a shift from large-current pulsed electron linac to continuous electron beam accelerator as a means of electron acceleration, mainly because 'exclusive', rather than 'inclusive', experiments have become necessary to permit detailed physical analysis. Polarization experiments, as well as coincidence experiments, are a major purpose of most of the new electron accelerators currently under plan or under construction. Thus, greater attention has been focused on the application of electron beam to polarization experiments as more efforts are made to make wider use of an electron accumulating ring. An important objective of polarization expperiments is to perform detailed analysis of the electromagnetic nature of atomic nuclei. Brief theoretical discussion of such nature is made on the basis of the electron scattering cross section, focusing on structure functions. For coincidence experiments, so-called out-of-plane observation is required to determine the structure functions separately. The combination of coincidence and polarization experiments can provide useful data for detailed analysis of the nature of nuclei. Some examples of such experiments are also described. (N.K.).

45132 (KEK–89-12, pp. 176-180) **Polarization experiments at Saturne (France).** Hasegawa, Takeo (Miyazaki Univ. (Japan). Faculty of Engineering). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (In Japanese). (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

At Saturne, a French national research institute, unique studies have been carried out based on polarization phenomena using the Sturne II synchrotron designed for the acceleration of polarized proton and deuteron beams, along with high-resolution spectrometers and polarized hydrogen targets. In particular, major efforts at Saturne have been focused on the physics at the boundary or contact point between atomic nuclei and elementary particles. Polarized beam is used for these studies. The Saturne II synchrotron covers energies up to 2.95 GeV for protons and 2.35 GeV for

deuterons. It is also possible to accelerate ^{3}He, alpha-particle and heavy-ion beams up to a maximum of 1.15 GeV per nucleon. These beams have been applied widely. A ring for accumulation and injection of beams, called Mimas, was installed in 1984 to enhance the intensity of polarized beam and widen the range of heavy ion nuclides that can be accelerated. Experiments with the ring began last year. The polarized beam intensity has increased by a factor 50 up to about 2×10^{11} p/cycle. The ring has two beam outlets to allow two sets of experiments to be performed in parallel. The report also briefly outlines major studies at Saturne related with polarization experiments. (N.K.).

45133 (KEK–89-19, pp. 43-47) **KENS-SAN, ISIS-LOQ, ILL-D17 and KENS-I'-SAN-II compared.** Furusaka, Michihiro (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2. workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. NEUTRON SOURCES/cold neutrons; SCATTERING; PULSED NEUTRON TECHNIQUES; COMPARATIVE EVALUATIONS; ACCELERATORS; REACTORS; NEUTRON FLUX; SMALL ANGLE SCATTERING; GAIN

45134 (KEK–89-19, pp. 65-81) **Upon commissioning of MARI: Proporsals and suggestions from the results done by the other chopper spectrometers.** Arai, Masatoshi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2. workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

The paper discusses the experiments on MARI for her commissioning. Those are suggested from the experiences obtained from the experiments in the existing chopper spectrometers HET in ISIS, LRMECS in IPNS and INC in KENS. The high energy magnetic excitation extended wide momentum transfer as well as the S(Q,w) measurements on some glass system are the most suitable test experiments to draw her powerful potentials using the benefits of the wide angular coverage of MARI. Multiple scattering correction is also one of the most important part on commissioning to have absolute values, which is especially important for glassy systems, and this is also inevitable task to get the high energy magnetic response from spin fluctuating magnetic system, where the neutron spin analysis is practically impossible. (author).

45135 (KURRI-TR–324) **Proceedings of the workshop on 'radiation protection in LINACs'.** Kato, Kazuaki; Urabe, Itsumasa (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Oct 1989. 47p. (In Japanese). (CONF-8908247–: Workshop on 'radiation protection in LINACs', Kumatori (Japan), 8 Aug 1989). Order Number DE90513927. Source: NTIS (US Sales Only), PC A03/MF A01.

The proceedings contain seven reports on electron and proton accelerators currently used in Japan. The first report describes the 'Present Condition of Linac Facilities in Japan – Questionnaire Survey'. It summarizes results of a questionnaire survey on 400 facilities where accelerators are used for research, industrial or medical applications. The second one deals with 'Radiation Protection at Nuclear Physics Research Institute of Tohoku University'. Safety measures taken in the institute are described. The third report outlines 'Radiation Protection at Linac Facility in Tokai Laboratory of Japan Atomic Energy Research Institute, focusing on equipment, radiation management, and safety measures. The fourth report, titled 'Proton Linac at High Energy Physics Research Institute', outlines major features of the facilities in the institute, radiation safety measures, etc. The fifth one describes the 'Safety Management at Electrotechnical Laboratory', centering on the equipment used, radiation management, and safety measures. The sixth one outlines major features of 'Electron Linac at Industrial Science Research Institute of Osaka University'. The seventh report describes the 'Present Condition of Neutron Generator (KURRI-LINAC)'. (N.K.).

45136 (LBL–28703) **Metal vapor vacuum arc ion sources.** Brown, I.G.; Dickinson, M.R.; Galvin, J.E.; Godechot, X.; MacGill, R.A. Lawrence Berkeley Lab., CA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9009192–10: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015719. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have developed a family of metal vapor vacuum are (MEVVA) high current metal ion sources. The sources were initially developed for the production of high current beams of metal ions for heavy ion synchrotron injection for basic nuclear physics research; more recently they have also been used for metal ion implantation. A number of different embodiments of the source have been developed for these specific applications. Presently the sources operate in a pulsed mode, with pulse width of order 1 ms and repetition rate up to 100 pps. Beam extraction voltage is up to 100 kV, and since the ions produced in the vacuum arc plasma are in general multiply ionized the ion energy is up to several hundred keV. Beam current is up to several Amperes peak and around 10 mA time averaged delivered onto target. Nearly all of the solid metals of the Periodic Table have been use to produce beam. A number of novel features have been incorporated into the sources, including multiple cathodes and the ability to switch between up to 18 separate cathode materials simply and quickly, and a broad beam source version as well as miniature versions. here we review the source designs and their performance. 45 refs., 7 figs.

45137 (LBL–28853) **A 5-cm dipole for the SSC-DE-1.** Caspi, S. Lawrence Berkeley Lab., CA (USA). 30 Apr 1990. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016616. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A 5cm SSC superconducting dipole that develops 6.6 tesla at 5790 A is proposed. The two layer magnet has 12% more transfer function than the present design as a result of using thin collars and "close in" iron. The thin collars provide precise positioning of the coils; they also provide minimum prestress (perhaps 2000 psi) as aid for magnet assembly. A welded skin around the iron provides the final prestress and shapes and the coil geometry. A prestressed aluminum bar placed between the vertically split iron yokes provides precise control of the gap between yokes halves and is designed to allow gap to close tightly during cooldown so that there is no decrease of prestress. In order to reduce the effect of iron saturation on the field multipoles the iron ID has been optimized to an elliptical shape. The coil inner layer is a 30 strand cable with 1.3:1 cu/sc. The outer layer is a 36 strand cable wit 1.8:1 cu/sc. At the operating field of 6.6 tesla the current density in the copper is 666 A/mm^2 and 760 A/mm^2 in the inner and outer layers respectively. The magnet short sample performance is limited by the inner layer. Operating at 4.35 K the maximum current and central field are 6896 A and 7.95 tesla. The calculated operating short sample temperature at 6.6 tesla and 5798 A is 5.17 K (0.82 K temperature margin). The magnet stored energy is 100.0 (KJ/m) at the 5790 A operating current. A mechanically similar 5cm bore two layer dipole for the cable test facility (D-16B-1) has been recently built and tested. The magnet had no collars and the iron was placed directly on the coil OD. The magnet's first quench was at 7 tesla with 6000 A and it reached 7.6 tesla at 6600 A. This paper contains tables and figures associated with the design.

45138 (LBL–29193) **Towards the construction of a high-intensity source of totally polarized electrons.** Zolotorev, M. Lawrence Berkeley Lab., CA (USA). May 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016617. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A scheme for construction of an intense source of totally polarized electrons is suggested with the parameters: 15 A current, 2 ns time duration and 180 Hz repetition rate. Such a polarized gun could be used at the SLAC Linear Collider.

45139 (LBL–29244) **Vacuum arc ion charge state distributions.** Brown, I.G.; Godechot, X. Lawrence Berkeley Lab., CA (USA). Jun 1990. 7p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Contract AR0116-89;Contract N00014-88-F-0093. (CONF-9009192–11: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015720. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have measured vacuum arc ion charge state spectra for a wide range of metallic cathode materials. The charge state distributions were measured using a time-of-flight diagnostic to monitor the energetic ion beam produced by a metal vapor vacuum arc ion source. We have obtained data for 48 metallic cathode elements: Li, C, Mg, Al, Si, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ge, Sr, Y, Zr, Nb, Mo, Pd, Ag, Cd, In, Sn, Ba, La, Ce, Pr, Nd, Sm, Gd, Dy, Ho, Er, Yb, Hf, Ta, W, Ir, Pt, Au, Pb, Bi, Th and U. The arc was operated in a pulsed mode with pulse length 0.25 msec; arc current was 100 A throughout. This array of elements extends and completes previous work by us. In this paper the measured distributions are cataloged and compared with our earlier results and with those of other workers. We also make some observations about the performance of the various elements as suitable vacuum arc cathode materials.

45140 (LYCEN–89-02 S.12.1-S.12.3) **Production and use of radioactive ion beams in Louvain-la-Neuve.** Van Duppen, P.; Dendooven, P.; Decrock, P.; Huyse, M.; Reusen, G.; Wauters, J. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Low energy radioactive ion beams are produced at the Leuven Isotope Separator On Line (LISOL) facility in Louvain-la-Neuve. The beams are used for standard nuclear spectroscopy studies and for Nuclear Orientation On Line measurements. A project to put a He-jet target system coupled with a single stage E.C.R. ion source on line with the mass separator will be presented. In september 1987 an other project was started to accelerate radioactive beams to higher energies. This will be done by coupling the two existing cyclotrons. A beam of ^{13}N will be produced in the summer of this year.

45141 (SAND–90-1243C) **Numerical models of injectors for high-current electron linacs.** Poukey, J.W.; Mazarakis, M.G. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009200–3: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE90016223. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have used four types of codes to aid in the design of injectors for our high-current linacs. The typical procedure begins with the electrostatic field code JASON to find a geometry with acceptable field stresses. Next, the 2-D electromagnetic PIC code MAGIC is used to study the addition of voltage waves from the input feeds, and the resulting beam generation and dynamics in a space-charge-limited diode. Then, the 2-D trajectory code TRAJ is used for parameter and optimization studies. Finally, in some cases 3-D effects may be examined with the PIC code QUICKSILVER. 10 refs., 4 figs., 2 tabs.

45142 (SAND–90-1268C) **Electron diodes and cavity design for the new 4-MeV injector of the recirculating linear accelerator (RLA).** Mazarakis, M.G.; Smith, D.L.; Poukey, J.W.; Bennett, L.F.; Olson, W.R.; Turman, B.N. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009200–2: 1990 LINAC conference, Albuquerque, NM (USA), 10-14 Sep 1990). Order Number DE90016224. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have designed and constructed four types of electron-beam diodes for the new 4-MV RLA injector: a non-immersed foilless diode, a magnetically immersed foilless diode, a foil diode and an ion-focused diode. They are tailored to fit the new injector cavity. The design goals were to produce high quality 10-kA to 20-kA electron beams with a $\beta\perp$ smaller than 0.2 and a beam radius of the order of 2 cm. These beams will be matched to the RLA IFR channel so $\beta\perp$ must be equal to or smaller than the square root of the ratio of the beam current versus Alfven current for $f_e = 1$. A reentrant anode geometry was selected for the injector cavity design, because it offers substantial savings on the required amount of ferromagnetic cores. The inner radius of the outside shell, now only 30 cm, would have been twice as large (60 cm) if a coaxial nonreentrant geometry had been adopted. The shape of the anode and cathode electrodes were carefully selected to minimize the electric field stresses. The field stresses on the inner surface of the outer shell do not exceed 200 kV/cm. 6 refs., 8 figs.

45143 (SAND–90-1522) **HERMES III Control and Monitor System, technical reference.** Mitchell, R.A. (Ktech Corp., Albuquerque, NM (USA)). Sandia National Labs., Albuquerque, NM (USA). 14 May 1990. 99p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90014867. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report describes the major hardware and software components of the HERMES III Control and Monitor System at the Simulation Technology Laboratory (STL) at Sandia National Laboratories. The HERMES III Control and Monitor System is a computer controlled system that controls and monitors the charging, arming, and firing of the HERMES III accelerator. This documentation is intended to be a general introduction to the system for engineers and technicians involved in the maintenance and modification of the system. It may also be useful to persons interested in designing and constructing a similar control system. This report collects many of the documents produced throughout the project and directs the reader toward other documents written for this project.

45144 (SAND–90-1963C) **Long pulse diode experiments.** McClenahan, C.R.; Weber, G.J.; O'Malley, M.W.; Stewart, J.; Rinehart, L.F.; Buttram, M.T. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9006228–2: 1990 annual charged particle beam meeting, San Diego, CA (USA), 11-14 Jun 1990). Order Number DE90016218. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A diode employing a thermionic cathode has produced 80 A beams at 200 kV for at least 6 μs. Moreover, the diode operates at rates as high as 1 Hz. EGUN simulations of the experimental geometry agree with the experiments. Finally, simulation of a proposed diode geometry predicts a 1 kA, 500 kV beam.

45145 A technique for efficient cleaning and conditioning of low- and medium-energy accelerators. Langley, R.A. (Sandia National Laboratories, Albuquerque, NM 87185 (USA)); McDonald, J.M. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 106-109 (5 Feb 1990). DOE Contract AC04-76DP00789. (CONF-8904230–: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

A technique was developed to clean and condition low- and medium-energy accelerators by alternating between a glow discharge with hydrogen gas and a glow discharge with oxygen gas. The technique was initiated on a 2.5-MV Van deGraaff accelerator and has been used on both lower-energy (down to 10-keV) and higher-energy (up to 10-MV) accelerators with equal effectiveness. The conditioning time for attaining the nominal maximum voltage on the 2.5-MV accelerator was reduced from about ten days using pumping and voltage conditioning to one day using the glow discharge technique. After a glow discharge conditioning sequence, the 2.5-MV accelerator could be operated effectively at energies of $\leq$3.4 MV. In addition, the accelerator tube life was found to be significantly longer than expected. The technique is described, and safety considerations are discussed.

45146 Reactive gas cleaning of accelerator vacuum systems. Hseuh, H.C. (AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, NY 11973 (USA)); Cui, X. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 124-134 (5 Feb 1990). (CONF-8904230–: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

Chemical cleaning, vacuum firing, glow discharge cleaning, and in situ bakeout have become standard practices for removing surface contaminants in the ultra high vacuum systems of particle accelerator and storage rings. In this work, an alternative method, reactive gas cleaning with nitric oxide (NO), has been studied. It was applied to several accelerator vacuum chambers made of stainless steel with surfaces ranging from clean to heavily contaminated by hydrocarbons. The effectiveness of the NO treatment has been compared with those of other treatments and found to be superior to vacuum firing alone, and is comparable with that of glow discharge cleaning.

4304 Storage Rings

Refer also to citation(s) 45126

45147 (GAO/RCED–90-33) **Federal research: information on site selection process for DOE's super collider.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Oct 1989. 26p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

In January 1989, the Secretary of Energy selected a site in Texas for the superconducting super collider from among seven best qualified sites. This report examines the overall selection process for the $4.4 billion high-energy physics facility. In particular, the report focuses on the consideration of Michigan's site proposal.

45148 (GSI–89-10, pp. 86-95) **Properties of electron-cooled beams at the IUCF cooler.** Pollock, R.E. (Indiana Univ., Dept. of Physics (USA)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. Grant PHY-82-11347. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The storage ring with electron cooling at the Indiana University Cyclotron Facility (IUCF) has begun operation within the past few months. Some properties of the cooled beams have been measured, and a few of the preliminary results are reported here. The data have been obtained with proton beams at the stripping injection energy of 45 MeV with intensities in the range 10^6 to 10^8 particles. Some results are also available for lower intensities of polarized and unpolarized protons at 148 and 180 MeV. (orig.).

45149 (GSI–89-10, pp. 140-156) **Interaction of crystalline beams with a storage ring lattice.** Hofmann, I. (GSI Darmstadt (Germany, F.R.)); Struckmeier, J. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

We present the results of numerical calculations for beams in realistic storage ring lattices under conditions, where crystalline order could be expected, at least in principle. In particular we discuss the effect of space charge, envelope instabilities, bending magnets and of cooling strength. Our conclusions on the lattice design require high symmetry and a small betatron tune. For three-dimensional ordering we find in addition that typically an e-folding of cooling is necessary after each bending section. The formation of order in a one- dimensional chain puts no restriction on the lattice, and a fraction of an e-folding of cooling once per revolution has been found sufficient. (orig.).

45150 (KEK–89-12, pp. 26-30) **Tohoku University multipurpose ring project.** Tamae, Tadaaki (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

A 300 MeV pulsed electron linac has been operating since 1967 in Tohoku University. The pulsed electron linac is a powerful tool for single arm experiments, but its poor duty factor of 0.1% makes it difficult to perform coincidence experiments, in which emitted particles are detected in coincidence with a scattered electron, because of a great number of accidental coincidence events. In order to improve the duty factor of the beam, a 150 MeV pulse stretcher (SSTR) was constructed in 1981 as a prototype of a proposed 1.5 GeV pulse stretcher ring. A ring with a circumference of about 15 m accepts pulsed beam from the electron linac and produces a continuous current. A pulsed beam with a time width of 50 nsec is injected at every 3.3 msec and extracted between two successive injections. The beam is extracted using a monochromatic extraction method. An extracted beam of 1 μA has been obtained with a duty factor of 80%. The energy spread of the extracted beam is measured and found to be 0.2%. The SSTR has been extensively evaluated while supplying a continuous beam to a tagged photon system and (e, e'p) and (e, e'n) coincidence facilities. (N.K.).

45151 (KEK–89-12, pp. 31-34) **Electron synchrotron for HiSOR.** Endo, I. (Hiroshima Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

Hiroshima University has a plan to construct a synchrotron radiation facility, called HiSOR. The report gives a brief description of the accelerator system. The storage ring is designed to be compact but capable of supplying synchrotron light in a wide energy range from VUV to hard X-ray. This feature is achieved by inserting super-conducting wigglers in a storage ring operated at relatively low energy. The storage ring for HiSOR is a 1.5 GeV machine which has a six dispersion-free straight sections. The magnetic lattice is the Chasman-Green DFA. The circumference of the ring is 100 m and well fits in the small site allocated in the university. The beam emittance is $8*10^{-8}\pi$·m·r, which is smaller than any other storage ring currently operating at energies higher than 1.5 GeV. The HiSOR storage ring employs a full-energy injection scheme in which the injection energy coincides with the storage energy. It has been decided to construct a 1.5 GeV synchrotron as injector. The circulating current will be 10-50 mA. The time structure of the magnet current is trapezoidal; electrons are injected by a 45 MeV linac, accelerated to 1.5 GeV in a ramp time of 0.5 sec, and kept 1.5 GeV for 1-2 sec. Slow extraction will be mainly used for nuclear physics experiments using either electrons or high energy bresstrahlung. (N.K.).

45152 (LAL-RT–89-10) **Analytic calculation of depolarization due to large energy spread in high-energy electron storage rings.** Buon, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Aug 1989. 7p. (CONF-890803–: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90514625. Source: NTIS (US Sales Only), PC A02/MF A01.

A new semiclassical and stochastic model of spin diffusion is used to obtain numerical predictions for depolarization enhancement due to beam energy spread. It confirms the results of previous models for the synchrotron sidebands of spin resonances. A satisfactory agreement is obtained with the width of a synchrotron satellite observed at SPEAR. For HERA, TRISTAN, and LEP at Z_0 energy, the depolarization enhancement is of the order of a few units and increases very rapidly with the energy spread. Large reduction of polarization degree is expected in these rings.

44 INSTRUMENTATION

Refer also to citation(s) 45051, 45052, 45913, 45915

45153 Laser-noise-induced intensity fluctuations in an optical interferometer. Ferguson, B.A. (School of Electrical Engineering, Purdue University, West Lafayette, Indiana 47907 (USA)); Elliott, D.S. *Physical Review, A (General Physics) (USA),* 41(11): 6183-6192 (1 Jun 1990).

We calculate the intensity fluctuations of the light transmitted by a Fabry-Perot interferometer when a broadband laser is incident upon

it. The laser field is assumed to have a Lorentzian spectrum and to be broadened by random amplitude fluctuations (real or complex) or random frequency fluctuations. In each case we obtain closed-form expressions for the intensity autocorrelation function, from which we can obtain the magnitude of the intensity fluctuations, as well as the power spectrum. These results indicate a strong dependence of the transmitted intensity fluctuations on the higher-order statistical properties of the incident field. Agreement with similar results concerning atomic fluorescence fluctuations is very good.

4401 Radiation Instrumentation

Refer also to citation(s) 43918, 43956, 43957, 44009, 44013, 44015, 44018, 44307, 44858, 45105, 45590, 45686, 45691, 45695, 45696, 45791, 45793, 45794, 45796, 45797, 45798, 45898, 45899, 45912, 45917, 45919, 45941, 45994, 46044, 46053

45154 (BMU–1989-238) **Testing measurement systems for finding radioactive sources - documentation of aircraft measuring missions flown in September 1988.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Winkelmann, I.; Endrulat, H.J.; Gesewsky, P.; Schuhbeck, S.; Schweiger, M.; Thomas, M. Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene. Feb 1989. 62p. (In German). Contract BMU St.Sch. 1032. (ABE–318). Source: Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The execution and results of test flights with helicopters for searching for or detecting radioactive materials are described, which were carried out to prepare for the crashing of the Kosmos 1900 satellite expected in October 1988. The results when overflying a Co 60 point source (1.1 GBq) at different altitudes and side distances are shown. To detect the radiation , 4"x5" diameter NaI (Tl) detectors, large pure germanium detectors (50% relative efficiency), a liquid scintillation counter and a dose rate measuring equipment were used. Point sources of a few 100 MBq were detected in the intergral measurement of the gamma radiation with the NaI detector when flying at an altitude of 100 m and with a speed of 100 km/hour (direct overflight). This value is increased by a factor of 3 when flying over and to one side in the same conditions at a distance of 100 m. In specific nuclide measurements with the Ge-D detector, one achieves comparable results. The radioactivities which can be detected by the various systems of measurement in various flight conditions or with various flight parameters are given for some relevant nuclides. Measurements with a liquid scintillation counter and a dose rate measuring equipment (MAB 604) have not led to any satisfactory results yet. Basically, both proved suitable for looking for radioactive sources, although with the above-mentioned flight parameters only activities from some GBq upwards could be measured. (orig./HP).

45155 (BONN-IR-90-16) **Development of algorithms for the particle separation by means of transition radiation.** Ahle, H. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. May 1990. 45p. (In German). Source: Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The ZEUS-Spectrometer is currently being built at HERA in Hamburg. One of the inner detectors, a transition radiation detector (TRD), is being conceived at the University of Bonn. It will identify single electrons inside hadronic jets of deep inelastic e-p-collisions. Test-modules of the TRD underwent measurements in electron/pion particle beams in CERN. The transition radiation was initiated by polypropylene fibres. The resulting ionisation clusters were registered in time expansion chambers. Already existing algorithms were further enhanced and improved for three different cluster analyzing methods. They were applied to the readout data, and then a maximum likelihood procedure was used on the results to obtain the electron probability of the observed event. A setup of four modules, as will be employed in ZEUS, was then calculated from the performance of one test-module. The aim of 1% misidentification at 90% electron detection efficiency in the energy range of 2-30 GeV was thus achieved. (orig.).

45156 (ENEA-RT-PAS–89-27) **Partial filtration to limit energy dependency of a single BeO TL dosemeter.** Monteventi, F.; Sermenghi, I. ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Jan 1990. 14p. (In Italian). (RT/PAS–89-27). Order Number DE90514494. Source: NTIS (US Sales Only), PC A03/MF A01.

Energy dependence is a very important characteristic to take into account in personal and environmental gamma dosimetry. The most commonly employed method to overcome the high energy dependence of thermoluminescent (TL) materials is based on the use of two or more TL detectors shielded in different ways. As for BeO material, an alternative method using a single, partially shielded (with 4.2 mm of lead 2.0 mm tin and 0.2 copper) BeO chip is suggested by the authors. The experiemental results have shown that, in above condition, a BeO dosemeter with an energy response better than plus/minus 10% in the energy range between 30 keV and 1250 keV is obtained. The main advantage of this method is the possibility of maintaining the same accuracy also in the presence of mixed energy photon fields.

45157 (FNAL-TM–1673) **On the electronics for Experiment E687's trigger on hadron momenta.** Ramusino, A.C. (Fermi National Accelerator Lab., Batavia, IL (USA)); Hansen, S.; Buchholz, D. Fermi National Accelerator Lab., Batavia, IL (USA). Jul 1990. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90014878. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this paper is to describe the electronic modules designed to process the E687 hadron calorimeter's 552 readout channels and generate a trigger signal based upon the total momentum and the total transverse momentum of the detected hadrons.

45158 (FRCEA-TH–280) **A parallel plate avalanche chamber for relativistic heavy ions.** Burgei, R. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie; Paris-11 Univ., 91 - Orsay (France). 1989. 209p. (In French). Order Number DE90514704. Source: NTIS (US Sales Only), PC A10/MF A01.

In order to determine the interaction point of relativistic heavy ions in the Diogene target, we have built and tested an X-Y low pressure parallel plate avalanche chamber. It uses three thin metallized foils and is filled with isobutane. A preliminary study shows that it is the only detector with the required specifications: efficiency, accurate position determination and a small uniform amount of material for the particle beam to go through. The electronics system is designed for reliability, easy adjustments and high stability. The interaction point is given on delay-line read-out. This represents the optimum compromise between low price and good performance. Laboratory measurements of gain, efficiency and position accuracy are done with an alpha-particle source. Two of these detectors are working at the Saturne National Laboratory. They allow the trajectory of several tens of particles (among a million per second) to be reconstructed. With an argon beam at 400 MeV per nucleon, the position uncertainty in the target has been measured to be 0.5 mm (standard deviation). This uncertainty is 0.3 mm for each detector, with an efficiency of 94 per cent. Our set-up, which is now operational, improves the accuracy of the results and speed of analysis of Diogene experiments devoted to the study of central collisions between heavy ions.

45159 (GSI–89-10, pp. 171-183) **Discussion of possible narrow-band pick-ups beyond 100 GHz.** Caspers, F. (CERN, Geneva (Switzerland)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The author describes the use of resonators for the diagnostics of crystalline ion beams. After a presentation of electric-field calculations in resonators with disturbances caused by a beam bunch the construction of receivers is described. (HSI).

45160 (GSI–89-10, pp. 184-193) **Possible laser diagnostic methods for ordered systems.** Neumann, R. (Physikalisches

Inst., Heidelberg Univ. (Germany, F.R.)). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Apr 1989. (CONF-8810321–: Workshop on crystalline ion beams, Wertheim (Germany, F.R.), 4-7 Oct 1988). In *Proceedings of the workshop on crystalline ion beams.* Order Number DE90517241. Source: NTIS (US Sales Only), PC A15/MF A01.

The author describes the application of laser radiation for ion beam monitoring. For this case he discusses Bragg scattering of laser light, resonant elastic Rayleigh scattering, and fluorescence. (HSI).

45161 (INS-T–495) **Automatic test system of the photomultipliers.** Shiino, Kazuo; Kono, Koji; Ishii, Takanobu; Kasai, Seiji; Yamada, Sakue; Kitamura, Shoichi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 40p. (In Japanese). Order Number DE90513787. Source: NTIS (US Sales Only), PC A03/MF A01.

A test system of R580 photomultipliers (PMTs) was constructed for the ZEUS experiment HERA. In this report, we will describe the general feature of the test system, each component of the setup, the procedure of the measurements, the data analyses and the results of the first 800 PMT measurements. (author).

45162 (IPNO-T–89-06) **Study of thin nuclear detectors, using passivation and ion implantation technologies and epitaxial silicon. Applications to heavy ions and synchrotron radiation.** Lavergne-Gosselin, L. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Jan 1989. 180p. (In French). Order Number DE90514632. Source: NTIS (US Sales Only), PC A09/MF A01.

Thin nuclear detectors using epitaxial silicon technology are described. The following manufacturing procedures are presented: the planar technology, which consists in the passivation of the surface for the background noise minimization and in ion implantation to obtain a PN junction; and the epitaxial silicon electrochemical machining, to obtain thin monocrystalline films. The detector's characterization is performed by means of alpha particles and x-rays, and their energy resolution is given. The results show that a suitable Z discrimination is obtained.

45163 (JAERI-M–90-025, pp. 268-276) **Secondary charged particle spectrometer based on two-dimensional E-TOF analysis.** Ogino, Seiji (Osaka Univ., Suita (Japan). Faculty of Engineering); Takahashi, Akito. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

This paper shows a spectrometer technique to measure energy spectral data for neutron-induced secondary charged particles -i.e, proton and alpha-particle, etc.- by analyzing energy (E) and time-of-flight (TOF) of charged particles in the two-dimensional E-TOF domain. Major problem in the measurement is how to decrease the backgrounds caused by neutron-induced charged particles and gamma-rays produced in the detector itself and from surrounding structural materials of the spectrometer. By reducing these backgrounds, energy spectra of neutron-induced secondary charged particles could be measured. (author).

45164 (JAERI-M–90-049) **Quantitative analysis for radiation image measured by bio-image analyzer.** Tanaka, Takaakira. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 29p. (In Japanese). Order Number DE90513759. Source: NTIS (US Sales Only), PC A03/MF A01.

Bio-image analyzer is a system for detecting radiation images. In the system, the radiation image recorded on the imaging plate (coated with photostimulable phosphor on a polyester plate) is read out as light signals by laser beam excitation and the image data are processed by a computer. This system is mainly applied for the autoradiography of biological samples. In order to clarify the characteristics of the analyzer, the factors that affect to the quantification of radiation image have been investigated. The photostimulable phosphor shows the fading phenomenon and its quantity depends on the preservation temperature and period. Irradiating C14-β ray for definite time, the plates were preserved for 1 hour to 14 days under 10degC to 40degC and read out. The absolute output value, defined as a value unaffected by fading, was determined from the relation between irradiation time and the output, by extraporating the time to zero. Compared to the absolute value, the calibration factors were calculated and expressed as the function of storage time and temperature. The fading effects after Tl204-β and γ ray irradiation were also examined and the fading rates almost coincide with that of C14-β ray. (author).

45165 (JAERI-M–90-069) **Extremely low level waste gamma-scanner and its characters.** Manabe, Iwao (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kawasaki, Katsuya; Minami, Kentaro. Japan Atomic Energy Research Inst., Tokyo (Japan). Apr 1990. 52p. (In Japanese). Order Number DE90513762. Source: NTIS (US Sales Only), PC A04/MF A01.

It is necessary in reactor dismantling that a large amount of radioactive solid waste arising should be reasonably treated and disposed according to the radioactive level of them. An extremely low level waste γ-scanner has been developed for the purpose of efficiently classifing and confirming the extremely low level radioactive solid waste by γ-ray spectrometry. The system which consists of a scanning mechanism of waste container, a couple of HPGe detectors and multichannel analyzers, and a minicomputer system, can measure automatically radioactivity for each nuclide in the wastes such as concrete in the three types of container. Detection efficiency calibration factors of this system are to be decided for each container by functions of γ-ray energy and effective density of waste in the container. A verification test with radioactive standard containers showed that the calibration factors gave precision within 10-percent for typical radionuclides in the homogeneous specimen. The minimum detectable limit of radioactivity concentration of this system is about 7.5×10^{-3} Bq/g for ^{60}Co in 200 l drum container in measuring time of 600 seconds regardless of their density. This system can classify about 1,000 kg of the waste an hour. (author).

45166 (LAL-RT–89-08) **The FPAX fastbus module.** Barlag, S.; Bouquet, B.; Lavigne, B.; Rypko, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jul 1989. 3p. (CONF-890545–: 6. conference on real-time computer applications in nuclear, particle and plasma physics, Williamsburg, VA (USA), 15-19 May 1989). Order Number DE90514624. Source: NTIS (US Sales Only), PC A02/MF A01.

The FPAX is a Fastbus module with 4 independent, 2 slave and 2 master, ports on two segments. It operates as a normal master on either segment or as a Block-Mover on both. The processor board is based on a 68020 microprocessor. A local/network switch allows operation as a host or as a normal module on the Fastbus network.

45167 (LBL–29001) **Application of mathematical removal of positron range blurring in Positron Emission Tomography.** Haber, S.F.; Derenzo, S.E.; Uber, D. Lawrence Berkeley Lab., CA (USA). Apr 1990. 7p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC03-76SF00098. Grant P01-HL25840;Grant R01 CA48002. (CONF-900143–36: Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium, San Francisco, CA (USA), 15-19 Jan 1990). Order Number DE90015313. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The range of positrons in tissue is an important limitation to the ultimate spatial resolution achievable in Positron Emission Tomography. In this work we applied a Fourier deconvolution technique to remove range blurring in images taken by the Donner 600-Crystal Positron Tomograph. Using phantom data, we found significant improvement in the image quality and the FWHM for both ^{68}Ga and ^{82}Rb. These were successfully corrected so that the images and FWHM almost matched those of ^{18}F which has negligible positron range. However, statistical noise was increased by the deconvolution process and it was not practical to recover the full spatial resolution of the tomograph. 10 refs., 6 figs., 3 tabs.

45168 (LYCEN–89-02 C.7.1-C.7.8) **Low energy π^+ electroproduction.** Fournier, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Haute Energie). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (In French). (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10

Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

At the ALS a magnetic spectrometer has been realized to detect π^+ at low energy. The electroproduction of π^+ at low energy, with separation of transverse and longitudinal cross sections, presents the main characteristics of a coincidence experience with an electron beam and gives the occasion to insist on experimental problems.

45169 (N–90-23294) **The energetic gamma-ray experiment telescope (EGRET) science symposium.** Fichtel, C.E.; Hunter, S.D.; Sreekumar, P.; Stecker, F.W. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. May 1990. 327p. (NASA-CP–3071;NAS–1.55:3071;CONF-8911215–: EGRET: energetic gamma-ray experiment telescope science symposium, Greenbelt, MD (USA), 15-16 Nov 1989). Source: NTIS, PC A15/MF A02; 1 functional color page.

Original contains color illustrations.

The principle purpose of this symposium is to provide the EGRET (energetic gamma-ray experiment telescope) scientists with an opportunity to study and improve their understanding of high energy gamma ray astronomy. The Symposium began with the galactic diffusion radiation both because of its importance in studying galactic cosmic rays, galactic structure, and dynamic balance, and because an understanding of its characteristics is important in the study of galactic sources. The galactic objects to be reviewed included pulsars, bursts, solar flares, and other galactic sources of several types. The symposium papers then proceeded outward from the Milky Way to normal galaxies, active galaxies, and the extragalactic diffuse radiation.

45170 (NFL–61) **On the use of the cold time-of-flight spectrometer in Studsvik for liquid ^{3}He measurements.** Faak, Bjoern. Uppsala Univ., Nykoeping (Sweden). Studsvik Neutron Research Lab. 1989. 14p. Order Number DE90637153. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The time-of-flight spectrometer for cold neutrons at the R2 reactor in Studsvik has been reconstructed. The design and the performance of the instrument are briefly described. Improvements required for measurement of the neutron scattering function of liquid ^{3}He are discussed. (author).

45171 (ORNL/FTR–2727) **[Neutron dosimetry]: Foreign trip report, October 10–17, 1987.** Swaja, R.E. Oak Ridge National Lab., TN (USA). 28 Oct 1987. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015622. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the Sixth Symposium on Neutron Dosimetry during October 12–14, 1987, at the Gesellschaft fur Strahlen-und Umweltforschung in Neuherberg, Federal Republic of Germany. This conference included a very comprehensive program with technical presentations in all areas of neutron dosimetry including several currently controversial topics such as quality factors, passive personnel dosimeters, bubble detectors, and survey instruments. The conference was attended by more than 200 people form about 15 countries including many recognized experts in radiation dosimetry, radiobiology, and microdosimetry. The traveler presented a paper containing results of neutron personnel dosimetry research studies conducted since 1974 at the Oak Ridge National Laboratory. During the symposium, the traveler discussed possible future collaborative research efforts with personnel from facilities associated with the Commission of European Communities in areas concerning neutron spectrometry and passive dosimeter testing. These discussions were continued during a visit to the Atomic Energy Authority Laboratories in Harwell, United Kingdom, on October 15, 1987. Through the conference attendance and discussions with dosimetry researchers, the traveler gained information concerning directions and philosophies in neutron dosimetry and made preliminary plans for future cooperative research efforts which will be directly related to DOE programs.

45172 (PNL-SA–15936) **Comment on "the reduction of background signal in bismuth germanate scintillators".** Brodzinski, R.L. Pacific Northwest Lab., Richland, WA (USA). May 1988. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90015553. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The observation of ^{207}Bi activity is bismuth germanate scintillators is probably not due to cosmic proton bombardment of ^{206}Pb in the bismuth ore, but more likely due to cosmic-ray- produced neutron reactions on ^{209}Bi in the crystals themselves. This is analogous to the observed cosmic-ray-neutron-produced radioactivities present in germanium diode gamma-ray spectrometers.

45173 (RCNP-P–108, pp. 172-173) **Proposed array of ACS-gamma detectors at the University of Tsukuba.** Furuno, Kohei (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

A preliminary design of an array of Compton suppressed Ge detectors for nuclear structure studies is described. It consists of 6 high-resolution γ-ray detectors with BGO Compton suppression shield, neutron detectors and charged particle detectors for channel selection of a nuclear reaction. (author).

45174 (RFP–4435) **Development of compliance specifications for Rocky Flats Plant criticality alarm detectors.** Miles, R.E. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. [1990]. 52p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9008132–1: DOE criticality alarm workshop, Los Alamos, NM (USA), 14-16 Aug 1990). Order Number DE90015673. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Criticality Alarm Detectors currently in use at the Rocky Flats plant consists of various types. One of these is a Tennelec Model # CAM 500 Surface Barrier Detector with a 490 square millimeter surface area. This document discusses the development of compliance specifications for Rocky Flats Plant criticality alarm detectors. 21 figs., 11 tabs.

45175 (RISO-M–2733) **X-ray spectrometer instrumentation with a personal computer.** Skaarup, P.; Vogeley, E. Risoe National Lab., Roskilde (Denmark). Electronics Dept. Jan 1989. 31p. Order Number DE90637249. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A description is given of an instrumentation for control of an X-ray spectrometer used in solid state physics experiments. The instrumentation includes a personal computer (PC) and a European Computer Bus (ECB) interface system. Details are given of the operating software. (author).

45176 (SAND–89-2587C) **Calibration and intercomparison efforts for neutron fluence monitoring.** Vehar, D.W. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900814–5: 7. ASTM-EURATOM symposium on reactor dosimetry, Strasbourg (France), 27-31 Aug 1990). Order Number DE90015846. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Three aspects of a quality assurance program for neutron fluence measurements as implemented by the Radiation Dosimetry Laboratory at Sandia National Laboratories are discussed. These elements are calibrations, routine checks of system performance, and interlaboratory comparisons. Historical data are presented for interlaboratory comparisons which illustrate nominal agreement within 10 percent among several laboratories for the period from 1981 to 1990. Recommendations for continued work and methods for data reporting are given. 7 refs., 1 fig., 1 tab.

45177 (SSI–90-03) **Reference instrument for radon measurements: Documentation of a radon measuring instrument based on alpha-spectrometry of electrostatically collected radon daughter elements.** Moere, Hans. National Inst. of Radiation Protection, Stockholm (Sweden). 25 Jan 1990. 28p. (In Swedish). Order Number DE90637250. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An instrument was built that collects radon daughter elements on an α-detector by means of an electric field. The instrument consists of an aluminium ball and an insulated surface barrier detector; over these parts is applied a voltage of 8 kV. The decay of radium A is recorded by a multi-channel analyzer and evaluated. The calibration factor was 944 Bq/m^3 per counts/s $\pm$ 4% systematic error. The pressure-, voltage- and moisture-dependence was investigated. (G.B.) (11 figs., 5 tabs., 5 refs.).

45178 (UM-P–89/31) **Statistical analysis of interferometer detection systems.** Opat, G.I. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 15p. Order Number DE90637251. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Interferometers are often used to measure small phase shifts introduced into the paths of recombining beams by some physical influence. An analysis of the associated counting statistics is presented leading to a maximum likelihood prescription for extracting the (small) phase shift. Although presented in the context of neutron interferometry, the results are easily extended to other situations involving particle counting. 4 refs., 3 figs.

45179 Biological particle identification apparatus. Salzman, G.C.; Gregg, C.T.; Grace, K.; Hiebert, D. To Dept. of Energy, Washington, DC (USA). USA Patent 4,884,886/A/. 5 Dec 1989. Filed date 26 Jan 1989. USA Patent Application 7-302,036. Int. Cl. G01J 4/00. 16p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an apparatus and method for making multiparameter light scattering measurements from suspensions of biological particles. Fourteen of the sixteen Mueller matrix elements describing the particles under investigation can be substantially individually determined as a function of scattering angle and probing radiations wavelength, eight elements simultaneously for each of two apparatus configurations using an apparatus which includes, in its simplest form, two polarization modulators each operating at a chosen frequency, one polarizer, a source of monochromatic electromagnetic radiation, a detector sensitive to the wavelength of radiation employed, eight phase-sensitive detectors, and appropriate electronics. A database of known biological particle suspensions can be assembled, and unknown samples can be quickly identified once measurements are performed on it according to the teachings of the subject invention, and a comparison is made with the database.

4402 Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to citation(s) 44713, 45054

45180 (SAND–89-2284C) **Measured silicon displacement damage ratios support the need to replace the ASTM E-722 damage function with the NJOY calculated function.** Kelly, J.G.; Griffin, P.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900814–8: 7. ASTM-EURATOM symposium on reactor dosimetry, Strasbourg (France), 27-31 Aug 1990). Order Number DE90016225. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Experiments with discrete silicon bipolar transistors exposed to 14 MeV neutrons and Sandia Pulsed Reactor (SPR III) fission type neutrons demonstrate that the silicon damage function listed in ASTM standard E-722 needs to be replaced by the NJOY calculated function to ensure simulation fidelity in testing for transient radiation effects in electronic devices. An annealing procedure applied between exposures ensured accurate damage comparisons between the two environments. Re-evaluation of the dosimetry foil cross sections and fluence determination methodology was also necessary to ensure that damage per neutron/cm^2 could be evaluated properly. The results provide a clear distinction between the two damage predictions and show that the NJOY function is the one of choice. 15 refs., 2 figs., 1 tab.

45181 (SAND–90-1924C) **Functional modeling of the transient radiation response for GaAs thyristors.** Keshavarz, A.A. (New Mexico Univ., Albuquerque, NM (USA). Center for High Technology Materials); Carson, R.F.; Weaver, H.T.; Hughes, R.C.; Hawkins, C.F. Sandia National Labs., Albuquerque, NM (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900723–14: 27. IEEE annual international nuclear and space radiation effects conference, Reno, NV (USA), 16-20 Jul 1990). Order Number DE90015209. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Numerical simulations of the transient response of gallium arsenide (GaAs) thyristors to bursts of ionizing radiation are reported. The device simulator BAMBI 2.0, with incorporated GaAs transport models, was used. Good experimental agreement exists, including effects of carrier lifetime on the radiation response and the phenomena of delayed switching. 13 refs., 8 figs.

45182 Radiation effects on MOS devices and circuits. Dressendorfer, P.V. (Sandia National Lab., Albuquerque, NM (US)). pp. 256-332 of Ionizing radiation effects in MOS devices and circuits. Ma, T.P.; Dressendorfer, P.V. John Wiley and Sons Inc., New York, NY (USA) (1989).

The present chapter considers in detail the effects that occur in MOS devices and circuits when exposed to ionizing radiation and that result from these two types of radiation-induced charge. The discussion centers on the effects of radiation on MOS capacitors, since historically many studies of radiation damage have used capacitors as the primary vehicle for investigation. It is shown that results for capacitors are applicable to the basic building block of an MOS integrated circuit, the MOS transistor. The author presents a detailed description of the effects observed on MOS transistors and how these effects vary as a function of bias applied to the transistor during irradiation. In conjunction with this discussion, special considerations necessary for transistors on silicon-on-sapphire (SOS) or silicon-on-insulator (SOI) substrates and for small-geometry devices are described. Comments is made on the effects of parasitic structures associated with the field oxide isolation of a typical technology and how these must be accounted for in understanding and interpreting the radiation response of gate oxide transistors or full integrated circuits.

45183 Radiation-hardening technology. Dressendorfer, P.V. (Sandia National Lab., Albuquerque, NM (US)). pp. 333-400 of Ionizing radiation effects in MOS devices and circuits. Ma, T.P.; Dressendorfer, P.V. John Wiley and Sons Inc., New York, NY (USA) (1989).

This chapter discusses the effects of various processing steps on the subsequent radiation response of MOS devices, with a restriction to those results available in the open literature. A typical process flow or lot traveler for a CMOS integrated circuit may consist of over 300 distinct steps, including such processes as cleans, oxidations, implants, diffusions, depositions, photolithographic patterning, and etches. Each of these distinct steps in turn may consist of a large number of individual steps. For example, an oxidation process may require that the wafers be loaded into a furnace at a certain rate and temperature, the furnace be ramped to a higher temperature in a particular ambient, the ambient gases be changed one or more times during the oxidation, the furnace be ramped down in temperature in another ambient, and finally the wafers withdrawn at a specified rate. Many of these individual steps can have an impact on the radiation hardness of the resulting integrated circuit. Thus the number of process variables that would have to be considered in the making of a radiation-hardened CMOS integrated circuit can easily number in the thousands. Guidelines have been developed that can be followed to alleviate the need for detailed experimentation at each step. This chapter illustrates some of those guidelines.

45184 Transient-ionization and single-event phenomena. Kerns, S.E. (Dept. of Electrical Engineering, Vanderbilt Univ., Nashville, TN (US)); Shafer, B.D. pp. 485-576 of Ionizing radiation effects in MOS devices and circuits. Ma, T.P.; Dressendorfer, P.V. John Wiley and Sons Inc., New York, NY (USA) (1989).

In modern MOS microelectronic devices, information is stored as quantities of charge. This information can be stored on a single node, as in a dynamic random access memory (DRAM) or in a subcircuit with a stable, latched state, as in a static random access memory (SRAM). Pulses of ionizing radiation are known to be effective in corrupting the information integrated circuits (ICs) store. This chapter reviews the effects of two classes of transient ionizing

radiation environments - pulsed photon (γ- and X-ray) radiation, and radiation from high-energy, cosmic ions - on the information content and stability of integrated circuits. The focus of this chapter is on soft error mechanisms for information loss in silicon MOS structures and circuits, although some of the references cited refer to knowledge on single-event effects gained from research on other technologies [such as bipolar silicon and field-effect transistor (FET) GaAs]. A soft error is correctable simply by reentering correct information into the affected elements. Two mechanisms for the generation of soft errors - interactions of single particles and pulses of ionizing radiation - are discussed, with emphasis on single events.

4404 Well Logging Instrumentation

Refer also to citation(s) 45347

4405 Thermal Instrumentation

45185 (MLM-3646(OP)) **Calorimetry modeling.** Robinson, C.E. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-9007106-56: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015743. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A heat-flow calorimeter has been modeled on a Compaq PC, using the Algor Heat Transfer Modeling and Analysis Program, Algor Interactive Systems, Inc., Pittsburgh, PA. Employed in this application of the Algor finite element analysis program are two-dimensional axisymmetric thermal conductivity elements. The development of a computer calorimeter modeling program allows for the testing of new materials and techniques without actual fabrication of the calorimeter. 2 figs.

45186 (MLM-3651(OP)) **Automated calorimeter testing system.** Rodenburg, W.W.; James, S.J. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-9007106-57: Institute of nuclear materials management conference, Los Angeles, CA (USA), 15-18 Jul 1990). Order Number DE90015747. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Automated Calorimeter Testing System (ACTS) is a portable measurement device that provides an independent measurement of all critical parameters of a calorimeter system. The ACTS was developed to improve productivity and performance of Mound-produced calorimeters. With ACTS, an individual with minimal understanding of calorimetry operation can perform a consistent set of diagnostic measurements on the system. The operator can identify components whose performance has deteriorated by a simple visual comparison of the current data plots with previous measurements made when the system was performing properly. Thus, downtime and "out of control" situations can be reduced. Should a system malfunction occur, a flowchart of troubleshooting procedures has been developed to facilitate quick identification of the malfunctioning component. If diagnosis is beyond the capability of the operator, the ACTS provides a consistent set of test data for review by a knowledgeable expert. The first field test was conducted at the Westinghouse Savannah River Site in early 1990. 6 figs.

4406 Optical Instrumentation

Refer also to citation(s) 44503, 44659, 44693, 44939, 44972, 45034, 45064, 45202, 45206, 45253, 45254, 45255, 45256, 45463, 45466, 45556, 45685, 46092, 46241

45187 (EGG-M-90070) **Development of a fiber-optic based instrument for on-line Raman analysis of process chemical composition.** Kercel, S.W. (Tennessee Univ., Knoxville, TN (USA). Measurement and Control Engineering Center); Roberts, M.J.; Garrison, A.A.; Trimble, D.S. Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry. [1990]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-88ID12691. (CONF-901070-1: Sensors conference, New Orleans, LA (USA), Oct 1990). Order Number DE90009641. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An instrument for measuring the composition of chemical process streams at multiple points has been designed. It determines composition by a chemometric analysis of the spontaneous Raman spectrum. A Nd:YAG laser is used to excite the sample and an interferometer is used to detect the spectrum of the Raman-scattered light. The light from the laser is multiplexed to the measurement points through fiber optics. This allows the sharing of the expensive components of the system among several measurements. The instrument will be applied to distillation columns. The response time is approximately three minutes per measurement. The composition measurement range is from approximately 5% to 100% with an average error of less than 2% RMS. 8 refs., 6 figs., 4 tabs.

45188 (EPRI-NP-6932) **High-temperature optical-fiber pH sensors: Final report.** Angel, S.M. (Lawrence Livermore National Lab., CA (USA)); Poco, J.F. Electric Power Research Inst., Palo Alto, CA (USA); Lawrence Livermore National Lab., CA (USA). ©Aug 1990. 34p. Sponsored by Electric Power Research Institute. DOE Contract W-7405-ENG-48. Source: Research Reports Center, Box 50490, Palo Alto, CA 94303.

The motivation for the search for in-line instruments for pH and coolant oxidizing power, also known as redox potential or Eh, lies in the relationship between these quantities and corrosion damage to components containing high-temperature high-pressure water. These quantities can be readily measured by currently available probes if the coolant is cooled to room temperature. However, the corrosive nature of water changes dramatically between room temperature and full power plant operating temperatures (300°C), and the relationship between pH and Eh measured at room temperature and pH and Eh measured at high temperature is a function of the impurities in or the additives in the water. Furthermore, an in-line instrument would preclude the need for cooling samples prior to their measurement. In this report, the results of research on high-temperature optical-fiber pH sensors will be presented. We have shown that these sensors (optrodes) can be made to work in very-high-temperature (300°C) water for long periods and that it is possible to measure pH using fluorescent inorganic ions doped into solid matrices. A high-temperature pH optrode can be made using these techniques; however, more research is needed into the chemistry of the carrier matrices and fluorescent dopants. New types of materials should be studied, including solid polymer ionic conductors and high-temperature epoxies. Particular emphasis should be placed on developing an Eh optrode because it also will be very useful and probably more easily developed. Transition-metal ions and complexes, as well as certain stable organic dyes, (materials that are very stable at high temperature) should also be investigated as dopants.

45189 (ETDE-IT-90-17) **A transceiver optical sensor for instantaneous distances measurements with applications to large scenes profilometry.** Bartolini, L.; D'Amico, A.; Ferri De Collibus, M.; Fornetti, G.; Giordano, N.; Occhionero, G.; Papetti, F. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 2p. (CONF-9004238-1: 23. international symposium on remote sensing of environment, Bangkok (Thailand), 18 Apr 1990). Order Number DE90514492. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper Presented at the 23rd international symposium on remote sensing of environment (Bangkok, 18-25 Apr 1990).

Short communication MEASURING INSTRUMENTS/remote sensing; LASERS; TELESCOPES; HELIUM-NEON LASERS; OPTICAL FILTERS; PHOTOMULTIPLIERS; SIGNAL-TO-NOISE RATIO; POWER RANGE MILLI W

45190 (ETDE-IT-90-32) **A simple optical cryostat for operation at liquid nitrogen temperatures (portable model).** Baldacchini, G.; Montereali, R.M.; Bottomei, M.; Cardoni, P.; Scavarda do Carmo, L.C. ENEA, Frascati (Italy). Centro Ricerche Energia. 1988. 14p. (In Italian). Order Number DE90514508. Source: NTIS (US Sales Only), PC A03/MF A01.

For absorption and emission measurements for crystals containing impurities in the optical range of visible and near infrared radiation, a small and simple mobile optical cryostat, cooled with

liquid nitrogen, was developed. With the use of only two liters of nitrogen, it can be operated at 80 K for about 30 hours without any need of external pumping, and the temperature can be changed continuously from 67 K to 125 K. Moreover, the vacuum in the sample compartment, i.e. the insulated vacuum, is devoid of considerable vapours and gases and thus allows measurements of hygroscopic samples without the formation of unwanted films.

45191 (LBL–29150) **Characteristics of feasible images obtained from real PET [Positron Emission Tomography] data by MLE [Maximum Likelihood Estimator], Bayesian and sieve methods.** Llacer, J. (Lawrence Berkeley Lab., CA (USA)); Bajamonde, A.C. Lawrence Berkeley Lab., CA (USA). Jun 1990. 12p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC03-76SF00098. (CONF-900756–22: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015298. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The frequency spectral characteristics, bias and variance of images reconstructed from real Positron Emission Tomography (PET) data have been studied. Feasible images obtained from statistically based reconstruction methods have been compared to Filtered Backprojection (FBP) images. Feasible images have been described as those images that are compatible with the measured data by consideration of the Poisson nature of the emission process. The results show that the spectral characteristics of reconstructions obtained by statistically based methods are at least as good as those obtained by the FBP methods. With some exceptions, statistically based reconstructions do not exhibit abnormal amounts of bias. The most significant difference between the two groups of reconstructions is in the image variance, where the statistically based methods yield substantially smaller variances in the regions with smaller image intensity than the FBP images. 14 refs., 12 figs., 3 tabs.

45192 (PNL-SA–18152) **Planar waveguide spectrometer.** Goldman, D.S.; White, P.L.; Anheier, N.C. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-900756–36: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90016308. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An integrated optic consisting of buried diffraction gratings and a planar waveguide was developed as an internal reflectance element for broad-band spectroscopic analysis of liquids. Polystyrene or tantalum pentoxide waveguides were deposited over a pair of diffraction gratings etched into the surface of a glass slide. Multiwavelength light was focused through the substrate onto the first grating. Component wavelengths were coupled into the waveguide and spatially dispersed by the second grating after propagating through the waveguide. A silicon photodiode array detector was used to collect the spectra data. Our goal is to produce a compact, rapid spectrometer having no moving parts that can take advantage of fiber optics and fast array detectors in the visible and near-infrared regions for industrial process control. The thin planar waveguide provides enhanced sensitivity to analyze weaker absorptions in the near-infrared. 10 refs., 5 figs.

45193 (SAND–89-3009C) **A compact real-time acousto-optic image correlator.** Molley, P.A.; Stalker, K.T.; Sweatt, W.C. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900756–24: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015564. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The design and development of a compact acousto-optic image correlator capable of performing real-time correlations on grayscale imagery will be described. The system utilizes one-dimensional optical devices to perform the desired two-dimensional correlation. The two-dimensional correlation is performed as a series of multichannel time-integrating correlations between each input image line and a reference template that is stored in an electronic memory. The rows of the reference template are introduced into the processor in parallel using a one-dimensional laser diode array. The correlation in the vertical direction is performed using a modified charge-coupled device (CCD) operating in the shift-and-add mode. A laser diode array, as opposed to an LED array used in previous systems, provides more power so that full use can be made of the dynamic range capabilities of the acoustoptic device and CCD. Key features of the system will be presented, including the random access template memory, the custom laser diode array consisting of 64 individually addressed laser diodes, and the custom optical design to achieve nearly diffraction-limited image quality and compactness. 7 refs., 7 figs.

45194 (UCRL-CR–104144) **Final report on Arete's real-time processor.** Sanborn, J. (Arete Associates, Sherman Oaks, CA (USA)); Reder, L.; Tong, K. Lawrence Livermore National Lab., CA (USA); Arete Associates, Sherman Oaks, CA (USA). 12 Jan 1990. 35p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90015817. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is Arete Associates' final report on the initial phase of a project to develop a real-time processor for an airborne lidar system. Arete has developed a programmable Real-Time Processor (RTP) and image display and recording system. It is presently integrated with an ocean (water) lidar sensor (OWLS) system onboard one of the Navel Air Development Center's (NADC's) P-3A aircraft. The RTP is a rack mounted, PF/AT based system.

45195 (UCRL-JC–104337) **Comparison of electro-optic diagnostic systems.** Hagans, K.G.; Sargis, P.D. Lawrence Livermore National Lab., CA (USA). [1990]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–28: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015619. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have examined the component devices used in electro-optic transient recording systems and studied their contributions to system noise levels. This work includes the investigation of three system configurations: a 1300-nm laser diode system, an 810-nm Mach-Zehnder system, and a 1300-nm hybrid system. As a result of our work, we have developed a method of analysis for determining the theoretical noise sources in electro-optic transient recording systems. 1 ref., 2 figs., 1 tab.

45196 (UCRL-JC–104478) **Bispectral-based optimization algorithms for speckle imaging.** Goodman, D.M.; Lawrence, T.W.; Fitch, J.P.; Johansson, E.M. Lawrence Livermore National Lab., CA (USA). [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–25: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015610. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present results of a horizontal path imaging experiment using a 0.5-m telescope focused on a target 1.2 km away. We consider an extended representation of a satellite with grey scale and size variations. We imaged at 0.7 μm and found an average atmospheric degradation factor of $D/r_0 = 17$. We used a slow read-rate, bare CCD detector; thus, we had to deal with additive measurement noise. Our image reconstruction algorithms are based on the complex bispectrum, and we have demonstrated diffraction-limited imaging down to light levels approaching a few photons per speckle per resolution area. We have paid careful attention to the effects of additive noise on the reconstruction process and have shown that they can be adequately overcome. We present some new algorithms based on conjugate gradients and least squares. We demonstrate that these algorithms can improve image quality. 18 refs., 4 figs.

45197 **Laser-induced plasmas and applications.** Radziemski, L.J. (New Mexico State Univ., Las Cruces, NM (USA). Dept. of Physics); Cremers, D.A. 440p. Marcel Dekker Inc., New York, NY (USA) (1989).

This book discusses optical science, engineering, and technology. Topics covered include the laser and its many commercial and

industrial applications, the new optical materials, gradient index optics, electro- and acousto-optics, fiber optics and communications, optical computing and pattern recognition, optical data reading, recording and storage, biomedical instrumentation, industrial robotics, integrated optics, infrared and ultraviolet systems.

45198 **Photoacoustic generation of anisotropic pressure waves through photodissociation of Cl_2.** Park, S.M. (Department of Chemistry, Brown University, Providence, Rhode Island 02912 (USA)); Khan, M.I.; Diebold, G. *Optics Letters (USA)*, 15(14): 771-773 (15 Jul 1990).

Photodissociation of diatomic molecules by linearly polarized radiation in general produces an anisotropic distribution of recoiling atomic fragments. When a short burst of radiation dissociates a gas at low pressure, the collective linear momenta of the individual recoiling photofragments add at any point in space to act as a macroscopic pressure wave, the impulse corresponding to which can be detected by a sensitive microphone. We report here detection of anisotropic pressure waves from photodissociation of Cl_2 with 355-nm radiation. The experimental data show the pressure wave to be peaked in a direction perpendicular to the polarization direction of the incident radiation, indicating a predominantly perpendicular transition moment in Cl_2 at this wavelength.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 45253, 45254, 45255, 45256

4408 Miscellaneous Instrumentation

Refer also to citation(s) 43853, 44024, 44061, 44129, 44226, 44728, 44850, 44992, 45031, 45222, 45225, 45538, 45539, 45542, 45713, 46248, 46249, 46250

45199 (CONF-901058–1) **Use of motor current signature analysis at the EPRI M&D Center.** Haynes, H.D.; Kryter, R.C.; Stewart, B.K. Oak Ridge National Lab., TN (USA). [1990]. 38p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. incipient failure detection conference: predictive maintenance for the 90's; Philadelphia, PA (USA); 15-17 Oct 1990. Order Number DE90012595. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Motor current signature analysis (MCSA), a machinery monitoring technology developed by the Oak Ridge National Laboratory (ORNL), has been used to monitor a variety of electric-motor-driven devices at the Philadelphia Electric Company's Eddystone Generating Station as part of a program conducted by the EPRI Monitoring and Diagnostics Center. The purpose of this project is to demonstrate the ability of MCSA to monitor the occurrence of degradation in aging power plant equipment. An important aspect of the work has been the development and demonstration of an on-line, automated motor current data acquisition system for monitoring the performance of eight motor-operated valves (MOVs) located in the Unit 2 turbine steam extraction system. Improvements continue to be made in the on-line monitoring system, including development of an automated data analysis program that significantly reduces the time required to extract diagnostic information from the MOV motor current signatures. Using portable MCSA equipment, motor current data were acquired for additional MOVs, pumps, fans, compressors, and mills. These tests have provided important baseline signatures against which subsequent test data may be compared. This paper provides descriptions of the tested equipment, the MCSA techniques employed, samples of test data acquired from both the on-line and portable data acquisition systems, and plans for future work in this ongoing effort. 8 refs., 22 figs., 3 tabs.

45200 (LA–11908-MS) **GSHELL: Multichannel analyzer/multichannel scaler emulation software for IBM-PC-compatible computers.** Estep, R.J. Los Alamos National Lab., NM (USA). Aug 1990. 53p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90015396. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

We have developed a multichannel analyzer/multichannel scaler program for use on IBM-PC-compatible computers. This software, called GSHELL, offers several advantages over commercial emulation software. The principle advantages are the availability of fully documented source codes, compatibility with (potentially) all brands of hardware, advanced looping capabilities in ASCII command files, and access to global variables and spectra in user-written software. 6 figs.

45201 (LA-UR–90-2161) **Observations of tornadoes and wall clouds with a portable FM-CW Doppler radar: 1989–1990 results.** Bluestein, H.B. (Oklahoma Univ., Norman, OK (USA). School of Meteorology); Unruh, W.P. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Management & Administration; National Science Foundation. DOE Contract W-7405-ENG-36. Grant ATM-8902594;Grant X14U. (CONF-9010120–1: 16. conference on severe local storms, Alta (Canada), 22-26 Oct 1990). Order Number DE90013152. Source: NTIS, PC A02/MF A01 - OSTI.

The purpose of this paper is to report on our progress using a portable, 1 W,FM (frequency modulated)-CW (continuous wave) Doppler radar developed at the Los Alamos National Laboratory (LANL), to make measurements of the wind field in tornadoes and wall clouds along with simultaneous visual documentation. Results using a CW version of the radar in 1987–1988 are given in Bluestein and Unruh (1989). 18 refs., 2 figs., 1 tab.

45202 (LA-UR–90-2320) **VISAR [Velocity Interferometer System for Any Reflector]: Line-imaging interferometer.** Hemsing, W.F.; Mathews, A.R.; Warnes, R.H.; Whittemore, G.R. Los Alamos National Lab., NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-900756–14: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015028. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes a Velocity Interferometer System for Any Reflector (VISAR) technique that extends velocity measurements from single points to a line. Single-frequency argon laser light was focused through a cylindrical lens to illuminate a line on a surface. The initially stationary, flat surface was accelerated unevenly during the experiment. Motion produced a Doppler-shift of light reflected from the surface that was proportional to the velocity at each point. The Doppler-shifted image of the illuminated line was focused from the surface through a push-pull VISAR interferometer where the light was split into four quadrature-coded images. When the surface accelerated, the Doppler-shift caused the interference for each point on each line image to oscillate sinusoidally. Coherent fiber optic bundles transmitted images from the interferometer to an electronic streak camera for sweeping in time and recording on film. Data reduction combined the images to yield a continuous velocity and displacement history for all points on the surface that reflected sufficient light. The technique was demonstrated in an experiment where most of the surface was rapidly driven to a saddle shape by an exploding foil. Computer graphics were used to display the measured velocity history and to aid visualization of the surface motion. 6 refs., 8 figs.

45203 (LBL-PUB–475-Rev.-6/90) **National Center for Electron Microscopy user's guide: Revised.** Dahmen, U.; Krishnan, K.M.; Gronsky, R.; Thomas, G.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Jun 1990. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90015631. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The National Center for Electron Microscopy (NCEM) in the Materials and Chemical Sciences Division of the Lawrence Berkeley Laboratory is a high voltage electron microscope facility for ultra-high resolution or dynamic in-situ studies. This document provides an overview of the facility, equipment specifications, safety, and a discussion of proposal submission and scheduling for users.

45204 (PB–90-873928/XAB) **Scanning tunneling microscopy: Superconductor materials. January 1984-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1984-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 76p. Source: NTISPC N01/MF N01.

This bibliography contains citations concerning the development and utilization of scanning tunneling microscopy (STM) in surface topography analysis of superconductor materials. The citations cover the principles, operation, and implementation of STM. Specific materials analyzed by STM include bismuth, strontium, calcium, copper, yttrium, and barium. Some organic materials for superconductors are also analyzed. A separate Published Search covers the use of STM for analysis of semiconducting materials. (Contains 113 citations fully indexed and including a title list.)

45205 (SAND–90-0986C) **Scale model penetrator instrumentation and testing.** Salazar, V.P.; Franco, R.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901074–2: International telemetering conference, Las Vegas, NV (USA), 29 Oct 1990). Order Number DE90011227. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories Telemetry Technology Development Division has designed and fielded earth and ice penetrator instrumentation recorders for many years. Recently we developed a miniature, reusable, transient-event recorder for use in scale model penetration tests. The miniature size of the recorder permits testing of penetrators as small as 4 inches in outside diameter by 20 inches in length. The recorder can survive and record shock environments exceeding 4,000 times the acceleration of gravity (gs). Typical applications are rock, soil, and ice penetration tests launched from a gas gun developed by Advanced Projects Division 3. Typical impact velocities range from 600 to 1,000 feet per second. 8 figs., 2 tabs.

45206 (UCRL–102468) **Application of Fabry-Perot velocimetry to hypervelocity impact experiments.** Chau, H.H.; Osher, J.E. Lawrence Livermore National Lab., CA (USA). Jun 1990. 10p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-900756–26: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015612. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fabry-Perot (F-P) velocimeter is our main diagnostic tool for hypervelocity impact experiments with the electric gun. Because of its immunity to electromagnetic interference, F-P velocimetry is well suited to studying the performance of flyers, providing data on velocity calibration, acceleration characteristics, and material erosion as well as spallation of various materials under high-velocity impact, measurement of impact pressure pulses, and Hugoniot measurements of composite materials. We present results and data from selected experiments and compare them with code predictions. 9 refs., 10 figs.

45207 Effect of harmonics on watt hour meters-laboratory investigations. Ogundare, A.A. (North Carolina Agricultural and Technical State Univ., Greensboro, NC (USA). Dept. of Electrical Engineering); Kumar, A.; Collis, W.; Stevens, J. pp. 278-282 of Proceedings of the 32nd midwest symposium on circuits and systems. IEEE Service Center, Piscataway, NJ (USA) (1990). (CONF-8908225–: 32. Midwest symposium on circuits and systems, Champaign, IL (USA), 14-16 Aug 1989).

Laboratory investigation of the effect of harmonics on induction watt hour meters is presented in this paper. The study is focussed on the effects of harmonics when they are injected from the source side and also from the load side. The studies indicate that the watt hour meters give negative error when the frequency is injected from the source side. Moreover, higher negative error was observed for even order harmonics. An insignificant error was observed when similar studies were repeated from the customer side.

45208 Compact scanning tunneling microscope with easy-to-construct *X–Z* inertial sample translation. Meepagala, S.C. (Department of Physics, Polytechnic University, Brooklyn, New York 11201 (USA)); Real, F.; Reyes, C.B.; Novoselskaya, A.; Rong, Z.; Wolf, E.L. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA),* 8(4): 3555-3557 (Jul 1990).

A new compact scanning tunneling microscope (STM) with easy-to-construct *X–Z* inertial sample translation has been developed. A key feature of this design is that a single piezoelectric tube performs inertial sample translation, *X–Y* scan, and the *Z* feedback control. The performance of the STM is tested by imaging a highly oriented pyrolytic graphite sample. The ability of this STM to translate the sample laterally is demonstrated using a gold sample. The design is stable against the thermal drifts in the *X–Y* plane.

45209 Heterodyne laser diagnostic system. Globig, M.A.; Johnson, M.A.; Wyeth, R.W. To Dept. of Energy, Washington, DC (USA). USA Patent 4,907,885/A/. 13 Mar 1990. Filed date 17 Jan 1989. USA Patent Application 7-297,527. Int. Cl. G01B 9/02. 10p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes the heterodyne laser diagnostic system that includes, in one embodiment, an average power pulsed laser optical spectrum analyzer for determining the average power of the pulsed laser. In another embodiment, the system includes a pulsed laser instantaneous optical frequency measurement for determining the instantaneous optical frequency of the pulsed laser.

45210 Method and apparatus for simultaneously measuring spectral wavelengths present in electromagnetic radiation. Buican, T.N.; Martin, J.C. To Dept. of Energy, Washington, DC (USA). USA Patent 4,905,169/A/. 27 Feb 1990. Filed date 15 Jun 1989. USA Patent Application 7-366,348. Int. Cl. G01J 4/00. 20p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes an apparatus and method which simultaneously measures spectral wavelengths present in electromagnetic radiation. A modulatable birefringent optical element is employed to divide a polarized light beam into two components, thereby producing a phase difference in two resulting light beams such that the two beams can be made to interfere with one another when recombined, the interference pattern providing the wavelength information required for the analysis of the incident light. The interferometer thus created performs in a similar manner to a Michelson interferometer, but with no moving parts, and with a resolution dependent on the degree of phase shift introduced by the modulator.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 44017, 44426, 44966, 45231

45211 (AD-A–220970/8/XAB) **Evaluation of the vapor-protection capabilities of the M17 respirator/hood assembly on the USAF ground-crew chemical defense ensemble. Interim report, 21 March-2 June 1988.** Scott, W.R.; Simpson, R.E. Krug International, San Antonio, TX (USA). Technology Services Div. Oct 1989. 24p. Source: NTIS, PC A03/MF A01.

The hood used with the M17 respirator on the regulation United States Air Force (USAF) ground-crew chemical defense ensemble (CDE) may have deficiencies, both in construction and usage, in its ability to protect the neck from chemical agent vapors. The purpose of this study was to quantify vapor penetration under the hood skirt to the neck and measure the effect of this vapor penetration on vapor carry-through into the Toxic Free Area (TFA) of the Survivable Collective Protection Shelter Contamination Control Area (SCPS-2B CCA) facility at Brooks AFB, Texas. Test subjects, wearing the regulation ground-crew CDE, performed light exercises in a simulant vapor (methyl salicylate). Vapor concentrations were measured at the neck with Tenax tubes and in the SCPS-2B with sequential impingers. When the hood skirt was worn outside the CDE jacket, the standard configuration, the mean simulant vapor level at the neck was 29.6% of the outside vapor concentration. Placing the hood skirt underneath the CDE jacket resulted in an 87% decrease in the neck vapor concentrations and a 50% reduction in TFA vapor carry-through.

45212 (AD-A–221144/9/XAB) **Capillary-column ammonia chemical ionization GC-MS and MC-MS/MS detection of chemical warfare agents in a complex airborne matrix.** D'Agostino, P.A.; Provost, L.R.; Brooks, P.W. Defence Research Establishment

Suffield, Ralston, AB (Canada). Jan 1990. 29p. (DRES-SM–1305). Source: NTIS, PC A03/MF A01.

The chemical warfare agents, sarin and soman, were detected and confirmed during full scanning capillary column ammonia chemical ionization mass spectrometry at nanogram levels in spiked extracts of a diesel exhaust environment sampled onto the charcoal of a Canadian C2 canister. The selectivity of this ammonia chemical ionization enabled the use of selected ion monitoring and resulted in detection limits of 40 pg and just above 500 pg for sarin and soman respectively in this extract. This matrix, typical of what might be encountered under battlefield conditions, was used to evaluate capillary column ammonia chemical ionization tandem mass spectrometry as a possible verification technology. Chemical interferences were reduced and significantly better detection limits, 15 pg and 80 pg for sarin and soman respectively, were obtained during GC-MS/MS analysis of these agents in the presence of numerous interfering diesel exhaust and charcoal bed components.

45213 (AD-A–221233/0/XAB) **Design concepts for hardened communications structures. Technical report, 30 January 1986-31 December 1987.** Flathau, W.J.; Smith, W.G. JAYCOR, Vicksburg, MS (USA). 1 Mar 1990. 174p. (JAYCOR-J–650-87-002/2461). Source: NTIS, PC A08/MF A01.

An important component of any hardened command and control structure is the antenna system that provides communication with the outside world. Two types of antennae were considered; i.e., the whip type and the directional. The whip type for short-range communication and the directional for use primarily with satellites. In the super high-frequency range, the use of directional antennae having parabolic dishes greater than 8 feet in diameter are common. In the very extra high-frequency range, dishes that are 2 to 3 feet in diameter are used. The whip-type antenna should extend up to, say, 60 feet in the air. Based on this background, a family of structures was designed that can protect whip and directional antennae from the blast and shock effects from a 1-MT device for ground surface overpressure ranging from 15,000 to 500 psi. As the antennae, transmitters, receivers, power supplies, and lifting mechanisms will be located within such structures, appropriate shock spectra plots were developed to determine if the fragility level of pertinent equipment will be exceeded and for use in designing shock isolation systems. Button up periods of 1 week and 4 weeks were considered.

45214 (AD-A–221255/3/XAB) **Effects of the chemical-defense antidote atropine sulfate on helicopter-pilot performance: A simulator study. Final report.** Simmons, F.R.; Caldwell, J.A.; Stephens, R.L.; Stone, L.W.; Carter, D.J. Army Aeromedical Research Lab., Fort Rucker, AL (USA). Jul 1989. 111p. (USAARL–89-17). Source: NTIS, PC A06/MF A01.

Atropine is fielded as an antidote for organophosphate poisoning where chemical nerve agents are used. However, inappropriate self-injection may lead to anticholinergic side effects detrimental to aviators in flight. To determine the scope and magnitude of these possible side effects, 12 male Army helicopter pilots in good health flew several missions in a helicopter simulator after being injected (I.M.) with either a placebo or 2mg or 4mg of atropine sulfate. Physiological effects essentially followed the classical model. The 2 mg dose of atropine caused small degradations on some of laboratory-collected measures, but often did not produce effects, which differed significantly from those produced by a placebo dose. A 4mg dose of atropine, however, exerted a variety of statistically significant effects upon flight performance, contrast sensitivity, cognitive performance, tracking accuracy, and cortical evoked responses. The flight performance evaluations (both subjective and objective) showed statistically significant changes in the subject's abilities to fly the simulator. Results obtained from other tasks in the study suggest, further, the decrements in flight performance resulted from a slowing of both information processing and psychomotor performance. Atropine effects were not of sufficient magnitude to preclude further research under actual flight conditions.

45215 (AD-A–221602/6/XAB) **Militarily critical technologies list. Volume 1. List of militarily critical technologies.** Office of the Under Secretary of Defense (Acquisition), Washington, DC (USA). Oct 1989. 365p. Source: NTIS, PC A16/MF A02.

The FY 1989 MCTL is published in three volumes. The three volumes together outline those items which the Department of Defense considers militarily critical and furnishes detailed descriptions and rationales for inclusion of the items on the MCTL. Volume I, contains the list of militarily critical technologies required by the Export Administration Act of 1979, as well as particulars of all the critical elements. Topics include: Information systems and networks technology; Computer hardware technology; Computer software technology; Automated control of industrial systems (ACIS) technology; Materials and production technology; Directed Energy and Kinetic Energy systems technology; Semiconductor and electronic component technology; Instrumentation technology; Telecommunications technology; Communication, navigation, guidance, control and identification technology; Microwave millimeter wave technology; Optical technology; Sensor technology; Sea surface and undersea systems technology; Chemicals and biotechnology; Nuclear related technology; Survivability and hardening technology; Energy systems technology; Energetic materials and devices technology.

45216 (LA-UR–90-2483) **Performance, throughput, and cost of in-home training for the Army Reserve: Using asynchronous computer conferencing as an alternative to resident training.** Hahn, H.A. (Los Alamos National Lab., NM (USA)); Ashworth, R.L. Jr.; Phelps, R.H.; Byers, J.C. Los Alamos National Lab., NM (USA). [1990]. 6p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-9010155–1: Human factors society conference, Orlando, FL (USA), 8-12 Oct 1990). Order Number DE90014899. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Asynchronous computer conferencing (ACC) was investigated as an alternative to resident training for the Army Reserve Component (RC). Specifically, the goals were to (1) evaluate the performance and throughput of ACC as compared with traditional Resident School instruction and (2) determine the cost-effectiveness of developing and implementing ACC. Fourteen RC students took a module of the Army Engineer Officer Advanced Course (EOAC) via ACC. Course topics included Army doctrine, technical engineering subjects, leadership, and presentation skills. Resident content was adapted for presentation via ACC. The programs of instruction for ACC and the equivalent resident course were identical; only the media used for presentation were changed. Performance on tests, homework, and practical exercises; self-assessments of learning; throughput; and cost data wee the measures of interest. Comparison data were collected on RC students taking the course in residence. Results indicated that there were no performance differences between the two groups. Students taking the course via ACC perceived greater learning benefit than did students taking the course in residence. Resident throughput was superior to ACC throughput, both in terms of numbers of students completing and time to complete the course. In spite of this fact, however, ACC was more cost-effective than resident training.

45217 (PB–90-228511/XAB) **Development, use, marking, and stocking of fallout shelters. Directive.** Bee, T. Assistant Secretary of Defense (Production and Logistics), Washington, DC (USA). 31 Jul 1972. 11p. (DOD-D–3020.35). Source: NTIS, PC A03/MF A01.

The Directive cancels DoD Directive 3020.35, April 13, 1971. It provides objectives, policies, and criteria for development, use, marking and stocking of fallout shelters at Department of Defense installations located in the 50 United States, the District of Columbia, Puerto Rico and the territories and possessions of the U.S. under the provisions of Title 50, United States Code, Appendix 2287, Executive Order 10952 (as amended), and Executive Order 11490 (as amended).

45218 (SAND–90-0882C) **[Natural fragmentation of exploding cylinders].** Grady, D.E.; Hightower, M.M. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9008125–2: Explomet conference, San Diego, CA (USA), 12-17 Aug 1990). Order Number DE90016108. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The natural fragmentation of a 4140 steel cylinder fully loaded with RX-35-AN insensitive high explosive is investigated through experiment and analysis. Methods of Taylor and Gurney are used

to determine the fracture strain and kinematic state of the expanding cylinder. Energy methods based on mechanisms of both tension fracture and adiabatic shear fracture are used to calculate the circumferential fragmentation intensity. 9 refs., 5 figs.

45219 (UCRL-CR–104314) **Department of Defense methodology guidelines for High Power Microwave (HPM) susceptibility assessments: Draft.** Chesser, N.J. (ed.) (Directed Technologies, Inc., Arlington, VA (USA)). Office of the Secretary of Defense, Washington, DC (USA). Jan 1990. 100p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90015405. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

It is the intention of the National HPM Program to complete a series of tests over the next two years to validate the methodology described in these guidelines. When those tests are completed and results analyzed, this document will be revised to reflect lessons learned during the validation process. In addition, the Methodology Sub-Panel is compiling a second volume on specific measurement techniques. This volume (Volume 1) is intended to provide guidance to the Program Manager on the critical steps in a well-conceived test program. Volume 2 will provide detailed step-by-step information to the engineer who is responsible for performing the tests. The body of this volume is divided into seven sections. Sections 2 through 7 provide detailed descriptions of the activities within each of the modular steps which comprise the methodology schematically; Section 2: pre-test system analysis; Section 3: low power microwave tests – coupling/subsystem component tests; Section 5: susceptibility assessment and test planning; Section 6: high power microwave tests; and Section 7: susceptibility assessment and test evaluation. The executive summary reviews the reasons for development of the methodology and provides brief descriptions of each module. Appendix B provides definitions of special terms and acronyms which are used throughout the document. 41 refs., 22 figs.

45220 (UCRL-JC–103603) **High resolution combat simulations to support training for close combat light applications.** Toms, R.M.; Dobbs, L.A.; Pimper, J.E. Lawrence Livermore National Lab., CA (USA). 14 Jun 1990. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9009172–2: Close combat light simulations technology conference, Albuquerque, NM (USA), 17-20 Sep 1990). Order Number DE90015149. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Superior tactical planning and maneuver synchronization are essential to fight and win on the CCL battlefield. This superiority can be achieved by the use of a combination of field exercises and high-resolution, computerized, combat simulation systems designed to support training. Computerized simulation systems provide a cost effective capability to promote learning through repetition and permit the exploration of scenarios that are impractical or dangerous to apply to live exercises. Man-in-the-loop, real-time, and force-on-force simulation systems with interactive color graphics interfaces are now available to support CCL training. Combat simulations have been developed specifically for this environment within the Conflict Simulation Laboratory (CSL) at the Lawrence Livermore National Laboratory (LLNL). Research and development efforts are underway that will greatly improve these capabilities. Applications are envisioned in training support, mission planning, analysis of new tactics and weapons, real-time display, and real-time operational support. 32 refs.

4501 Chemical Explosions and Explosives

45221 (MLM–3645(OP)) **Finite difference modeling of laser diode ignited components.** Ewick, D.W. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900792–9: 15. international pyrotechnics seminar, Boulder, CO (USA), 9-13 Jul 1990). Order Number DE90015652. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The ignition characteristics of a laser diode ignited pyrotechnic component were modeled by using a finite difference technique to solve the governing time-dependent heat transfer equation. The model was used to calculate the ignition time of Ti/$KClO_4$ and a CP/carbon black blend at various laser power levels. The effect of temperature on the laser ignition threshold of these materials was investigated over a range of −54°C to 74°C. The impact was found to be more significant for CP/carbon black than for $TiKClO_4$ because the latter has a higher auto-ignition temperature. The effect of the laser pulse rise time on ignition time was found to be significant only at relatively high power levels. The effects of both quartz and sapphire windows on the ignition threshold on CP/carbon black were also modeled. Because of beam divergence and conduction losses, these windows significantly affected the time-to-ignition and the laser ignition threshold. 11 refs., 13 figs., 2 tabs.

45222 (MLM–3647(OP)) **Analysis of pyrotechnic devices by laser-illuminated high speed photography.** Dosser, L.R.; Stark, M.A. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900756–34: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015741. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several types of pyrotechnic igniters have been evaluated using the technique of laser-illuminated high speed photography with a copper vapor laser. The accompanying video tape shows the results of high speed films recorded for two types of igniters (Type X1 and Type X2) fired in confinement in a lucite block and four types of igniters (Type X1, Type X2, Type X3, and Type X4) igniters fired at ambient. The films of the Type X1 and Type X2 igniters were recorded for both a coarse particle titanium potassium perchlorate (TiKP) output charge and a fine particle TiKP output charge. The results of these films are most informative, and the technique is shown to be useful as a design tool for studying the performance of igniters. 2 figs., 1 tab.

45223 (MLM–3648(OP)) **Determination of closure disk rupture parameters.** Merten, C.W. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)); Robinson, M.A.; Evans, N.A. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900792–11: 15. international pyrotechnics seminar, Boulder, CO (USA), 9-13 Jul 1990). Order Number DE90015744. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The necessity of decoupling strain rate from burn rate effects for tests designed to characterize closure disks is discussed. A method for simulating the high rates of pressure increase to which closure disks are subjected and which does not employ pyrotechnic material as a means of pressurization is presented. It consists of slowly pressurizing both sides of a closure disk to a high pressure and then rapidly releasing the pressure from one side of the disk. Means of rapidly releasing gas from the downstream side of the closure disk and measuring the pressure differential across the closure disk are discussed in detail. Rates of pressure decrease as high as 335,000,000 psi/sec downstream from the closure disk have been attained. Baseline disks slotted by wire EDM failed at an average pressure differential of 10,150 psi. Disks slotted by chemical etching exhibited a higher burst pressure differential and greater variability. Glass-ceramic closure disks had the lowest average burst pressure and highest variability. An increase in the diameter of a closure disk was found to lower the pressure differential required to rupture the disk. Burst pressure was found to increase linearly with the thickness of the web in the slot. 5 refs., 6 figs., 5 tabs.

45224 (MLM–3649(OP)) **Development and evaluation of hermetic laser diode ignited pyrotechnic components.** Kramer, D.P.; Beckman, T.M.; Ewick, D.W. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-900792–12: 15. international pyrotechnics seminar, Boulder, CO (USA), 9-13 Jul 1990). Order Number DE90015745. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The present research has focused on developing laser ignited components based on a laser/optical fiber combination in place of bridgewires and pins. This technology uses a laser diode to produce an output through the optical fiber of sufficient energy to

function the component. The fabrication of components containing lengths of optical fibers sealed to stainless steel connectors has been demonstrated. These components were determined to be hermetic with helium leak rates of $<1 \times 10^{-9}$ cm^3/s. The high temperatures required for seal formation did not modify the transmission and beam profile characteristics of the optical fibers. The function characteristics of the fabricated components were evaluated by loading the components and performing firing tests. Components were loaded with either Ti/$KClO_4$ or CP (2-[5-cyanotetrazolato] pentaamine cobalt III perchlorate). Firing tests were performed using AlGaAs laser diode arrays, which emit at a wavelength of approximately 850 nanometers. The diode was coupled to the pyrotechnic component via the optical fiber. 4 refs., 7 figs., 1 tab.

45225 (ORNL/ATD–2) **Naval Underwater Systems Center torpedo data acquisition system design update.** Adams, D.J.; Beshears, D.L.; Capps, G.J.; Jordan, J.K.; Napier, R.W.; Ott, G.W.; Scudiere, M.B.; White, C.P.; Nodine, R.N.; Todd, R.A. Oak Ridge National Lab., TN (USA). Applied Technology Div. Oct 1988. 86p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90014761. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

In the process of developing technology for torpedo applications, the Naval Underwater Systems Center test vehicles are instrumented with sensors (and signal processors), and their outputs are recorded during in water exercises. This paper defines the design for both the "wet" and "dry" systems. The wet system will be the on-board torpedo equipment used to monitor and record a multitude of transducer of transducer signals. The dry system will be used for programming the wet system, handling the test data, and performing quick-look signal analyses. The system will be used to monitor, record, and analyze an enormous volume of data from transducer signals during either routine or development in-water exercises. 24 figs.

45226 **Blank fire configuration for automatic pistol.** Teague, T.L. To U.S. Dept. of Energy, Washington, DC (USA). USA Patent 4,907,489/A/. 13 Mar 1990. Filed date 31 Aug 1988. USA Patent Application 7-238,450. Int. Cl. F41C 21/22. 6p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a pistol configured to fire blank cartridges that includes a modified barrel with a breech portion connected to an aligned inner sleeve. Around the inner sleeve, there is disposed an outer sleeve having a vent therein through which the cartridge discharges. The breech portion is connected to a barrel anchor to move backward in a slight arc when the pistol is fired. A spring retention rod projects from the barrel anchor and receives a shortened recoil spring therearound which recoil spring has one end abutting a stop on the barrel anchor and the other end in abutment with the end of a spring retaining cup. The spring retaining cup is engaged by a flange projecting from a slide so that when the pistol is fired, the slide moves rearwardly against the compression of the spring to eject the spent cartridge and then moves forwardly under the urging of the spring to load a fresh cartridge into the breech portion. The spring then returns all of the slidable elements to their initial position so that the pistol may again be fired.

45227 **Bonfire-safe low-voltage detonator.** Lieberman, M.L. To Dept. of Energy, Washington, DC (USA). USA Patent 4,907,509/A/. 13 Mar 1990. Filed date 1 Jul 1988. USA Patent Application 7-214,369. Int. Cl. F42B 3/18. 8p. Source: Patent and Trademark Office, Box 9, Washington, DC 20232 (USA).

This patent describes a column of explosive in a low-voltage detonator which makes it bonfire-safe that includes a first layer of an explosive charge of CP, or a primary explosive, and a second layer of a secondary organic explosive charge, such as PETN, which has a degradation temperature lower than the autoignition temperature of the CP or primary explosives. The first layer is composed of a pair of increments disposed in a bore of a housing of the detonator in an ignition region of the explosive column and adjacent to and in contact with an electrical ignition device to one end of the bore. The second layer is composed of increments disposed in the housing bore in a transition region of the explosive column next to and in contact with the first layer on a side opposite from the ignition device. The first layer is loaded under a sufficient high pressure, 25 to 40 kpsi, to achieve ignition, whereas the second layer is loaded under a sufficient low pressure, about 10 kpsi, to allow occurrence of DDT. Each increment of the first and second layers has an axial length-to-diameter ratio of one-half.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 44421, 45249

45228 (DOE/NV/10630–5) **Operation Touchstone: Onsite radiological safety report for announced nuclear tests, October 1987 through September 1988.** Mullen, O.W.; Jacklin, A.K.; Eubank, B.F. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA). Oct 1989. 98p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-89NV10630. Order Number DE90016133. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Touchstone was the name assigned to the series of underground nuclear experiments conducted at the Nevada Test Site (NTS) from October 1, 1987 through September 30, 1988. This report includes those experiments publicly announced. Remote radiation measurements were taken during and after each nuclear experiment by a telemetry system. Radiation Protection Technicians (RPT) with portable radiation detection instruments surveyed reentry routes into ground zeros before other planned entries were made. Continuous surveillance was provided while personnel were in radiation areas, and appropriate precautions were taken to protect persons from unnecessary exposure to radiation and toxic gases. Protective clothing and equipment were issued as needed. Complete radiological safety and industrial hygiene coverage were provided during drilling and mineback operations. Telemetered and portable radiation detector measurements are listed. Detection instrumentation used is described and specific operational procedures are defined.

45229 (Y/DW–923) **An inside look at temperature measurement solutions from a casting facility.** Mee, D.K. (Oak Ridge Y-12 Plant, TN (USA)); Lind, R.F.; Bradley, N.C.; Childs, R.M.; Scott, K.J.; Tucker, R.W. Sr. Oak Ridge Y-12 Plant, TN (USA). 10 Mar 1990. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OS21400. (CONF-901017–4: International conference and exhibition of the Instrument Society of America, New Orleans, LA (USA), 14-19 Oct 1990). Order Number DE90011921. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Temperature measurement of molten uranium metal in casting furnaces has been a long-standing problem at the Oak Ridge Y-12 Plant. Automatic optical pyrometers used to measure surface temperatures were plagued with problems of emissivity differences across melt surfaces. The Plant responded to the need for an automatic measurement by taking a hard look at thermocouple and optical solutions to high temperature measurement. Existing thermocouple measurement problems were addressed. Products from several vendors of two-color optical pyrometers were placed on production furnaces and evaluated. For most areas, the two-color optical pyrometers was chosen as the best technique. Selling the use of automatic optical pyrometers to production personnel required on extensive data collection and analysis program. After analysis of the data, it became apparent that measurement variation in some areas was too large to satisfy production needs. To resolve measurement problems, a scanning technique was developed to provide intelligent selection of the optical target on the melt surface. By choosing a slag free area of the melt as a target, variations introduced by the slag were eliminated. Data which compared the traditional manual measurement to the scanning automatic measurement showed mean difference of less than 5°C with 2σ-limits (about the mean) of roughly ± 10°C. The work described in this paper has now brought good acceptance of automatic optical pyrometry in our casting facility. 6 refs., 1 tab.

4503 Nuclear Explosion Detection

45230 (AD-A–221533/3/XAB) **Equipment to support the development of high-resolution geophysical site-characterization procedures. Final report, 15 December 1988-14 December 1989.** Stump, B.W. Southern Methodist Univ., Dallas, TX (USA). Dept. of Geological Sciences. 13 Feb 1990. 24p. Source: NTIS, PC A03/MF A01.

An important application of high resolution geophysical exploration is the interpretation of strong ground motions from chemical and nuclear explosions. High dynamic range data acquisition systems which are capable of acquiring multiple channels of data are necessary. Ground motion sensors, data analysis microsystem, and field enclosures were supported under this grant. Spanning ground motions from the low level exploration environment to the strong levels next to explosive sources was done with a collection of geophones, seismometers, and accelerometers. Four applications of the new system are given, in a range of experiments from quantification of near-source ground motions from a contained nuclear explosion to the characterization of a new AFOSR supported shear wave generator.

4505 Strategic Defense Initiative

Refer also to citation(s) 44983, 44984, 44985, 44986, 44987, 44988, 44989, 45054, 45055, 45714, 45715, 45736, 45738, 45758, 45759, 45760, 45761, 45762, 45763, 45764, 45765, 45766, 45767, 45768, 45769, 45909

45231 (PB–90-873464/XAB) **Militarization of space. June 1970-June 1990 (A Bibliography from the NTIS data base). Report for June 1970-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 183p. Source: NTISPC N01/MF N01.

Supersedes PB–89-854871.

This bibliography contains citations concerning existing and projected military use of space by the United States and foreign powers. Long term strategies, technical feasibility studies, space weapons, including high-energy lasers, shuttle operations, and the use of space in tactical operations are among the topics considered. Many of the recent citations cover the Strategic Defense Initiative (SDI) program. (This updated bibliography contains 344 citations, 121 of which are new entries to the previous edition.)

45232 (UCRL–102625) **An x-band backward-wave oscillator experiment.** Camacho, J.F.; Rosenbury, E.T.; Poole, B.R. Lawrence Livermore National Lab., CA (USA). [1990]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006179–5: 5. national conference on high-power microwave technology, West Point, NY (USA), 10-15 Jun 1990). Order Number DE90015119. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are conducting a backward-wave oscillator (BWO) experiment using a slow-wave structure which consists of a non-sinusoidal corrugated-wall waveguide with period z_0 = 1.67 cm, r_{min} = 1.17 cm, r_{max} = 1.97 cm, and length L = 15.03 cm (nine periods). We inject an annular electron beam with the following parameters: $\Phi_{cathode}$ = 1 MV, 1 kA $\leq I_{beam} \leq$ 7 kA in 1 kA increments, r_{beam} = 0.9 cm, and $t_{pulse} \approx$ 60 ns. The guiding axial magnetic field is varied from 0.6 T to 3.0 T in 0.4 T increments. The device is designed to operate at 8.0 GHz < f < 8.5 GHz in the lowest-order TM mode of the coupled beam-structure system. We shall present our experimental design and results. In addition, our theoretical and modeling work will be discussed. 8 refs., 6 figs.

4506 Chemical and Biological

45233 (AD-A–221100/1/XAB) **Development of the minitube air-sampling system - an automated field sampling and analysis system.** Hancock, J.R.; McAndless, J.M.; Hicken, R.P. Defence Research Establishment Suffield, Ralston, AB (Canada). Jan 1990. 36p. (DRES-SR–512). Source: NTIS, PC A03/MF A01.

The design, operation and initial performance of the Minute Air Sampling System, an automated air sampling and analysis system for the monitoring of volatile organic compounds in air are described. This system, based on miniature solid adsorbent sampling tubes (minitubes) and thermal desorption gas chromatographic analysis, performs capillary column separations without cryogenic refocusing techniques. Capillary column separations equivalent to traditional syringe injection were achieved with a precision of one and five per cent with respect to retention time and peak area. The system has been field tested and was successfully used for the analysis of minitubes containing the chemical warfare agent mustard.

45234 (AD-A–221101/9/XAB) **Neural-network recognition and classification of aerosol particle-size distributions. Final report, June-October 1989.** Yee, E.; Ho, J. Defence Research Establishment Suffield, Ralston, AB (Canada). Jan 1990. 39p. (DRES-SR–531). Source: NTIS, PC A03/MF A01.

This paper describes the application of a neural computational network model to the pattern recognition and classification of aerodynamic particle size distributions associated with a number of environmental, bacterial, and artificial aerosols. The aerodynamic particle size distributions are measured in real-time with high resolution using a two-spot He-Ne laser velocimeter. The technique employed here for the recognition and classification of aerosols of unknown origin is based on a three-layered neural network that has been trained on a training set consisting of 75 particle size distributions obtained from three distinct types of aerosols. The training of the neural network was accomplished with the back-propagation learning algorithm. The effects of the number of processing units in the hidden layer and the level of noise corrupting the training set, the test set, and the connection weights on the learning rate and classification efficiency of the neural network are studied. The ability of the trained network to generalize from the finite number of size distributions in the training set to unknown size distributions obtained from uncertain and unfamiliar environments is investigated. The approach offers the opportunity of recognizing, classifying, and characterizing aerosol particles in real-time according to their aerodynamic particle size spectrum and its high recognition accuracy shows considerable promise for applications to rapid real-time air monitoring in the areas of occupational health and air pollution standards.

45235 (AD-A–221117/5/XAB) **Retention index monitoring of volatile organic compounds using thermal-desorption gas chromatography.** Hancock, J.R.; Peters, G.P. Defence Research Establishment Suffield, Ralston, AB (Canada). Dec 1989. 30p. (DRES-SR–537). Source: NTIS, PC A03/MF A01.

Retention index monitoring using thermal desorption gas chromatographic analysis was developed as a method for the verification of compounds of chemical defense interest in environmental matrices. Gas chromatographic (GC) retention indices were determined by loading solid adsorbent packed sampling tubes initially with the target compounds and subsequently with a series on n-alkane probes. The resulting chromatographic performance and GC retention indices were shown to be independent of the tube loading method. A database of GC retention indices for chemical warfare agents and simulants was compiled and, in conjunction with simultaneous flame ionization and flame photometric detection, applied to the identification of triethyl phosphate, tributyl phosphate and diethyl malonate in water and soil samples.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 44428

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 43702, 43713, 43716, 43839, 43840, 43924, 43963, 44010, 44086, 44210, 44314, 44355, 44389, 44395, 44457, 44500, 44571, 44581, 44582, 44583, 44599, 44789, 44874, 44895, 44960, 44975, 45233, 45234, 45335, 45343, 45443, 45446, 45448, 45462, 45467, 45481, 45496, 45500, 45501, 45505, 45507, 45509, 45617, 45633, 45920

45236 (AD-A–220918/7/XAB) **Oxides of nitrogen emissions from the testing of Tf41-A-2B engines at Naval Air Station, Lemoore, California.** Naval Air Rework Facility, North Island, CA (USA). Aircraft Environmental Support Office. Nov 1987. 87p. (AESO–1-88). Source: NTIS, PC A05/MF A01.

NOx are air pollutants from the testing of gas turbine engines. Out-of-airframe engine testing is regulated by air pollution control agencies which require NOx emissions data on applications for permits to construct and operate engine test facilities. Aside from

continuous emissions monitoring, current methods of determining NOx emissions from test cells depend on the availability of accurate records of engine operational data. This degree of record keeping is excessive given the difficult conditions under which engine testing is normally conducted. To avoid excessive record keeping, the Aircraft Environmental Support Office recommends a simple procedure for determining NOx emissions. Its use depends only on accurate records of fuel usage for each engine test run. The procedure involves the use of a correlation coefficient which relates the weight (pounds) of NOx emissions to the weight (pounds) of fuel consumed during engine testing. The coefficient is characteristic of a given engine type, demonstrating little variation among individual engines. This report establishes a correlation coefficient for the TF41-A-2B engine based on actual emissions data and the run sheets from 27 engine tests conducted in test cells at NAS Lemoore, CA. The correlation coefficient, equal to 0.01515 pounds of NOx formed per pound of fuel consumed, determined NOx emissions to within 1% of actual values. Analysis of the statistical validity of the coefficient supports its use as a reliable procedure.

45237 (AD-A–220919/5/XAB) **Emissions of nitrogen oxides from the testing of F404-400 engines at Naval Air Station, Lemoore, California.** Naval Air Rework Facility, North Island, CA (USA). Aircraft Environmental Support Office. Jul 1985. 50p. (AESO–4-85). Source: NTIS, PC A03/MF A01.

This report determined the weight of nitrogen oxides (NOx) coming from 13 different F404-GE-400 engine tests at NAS Lemoore. The weight of nitrogen oxides from each test was determined by adding the weights produced by each power setting used in the test. At each power setting, the amount of fuel used and the emission index for nitrogen oxides, which varies with the power setting, determine the amount of nitrogen oxides produced. The emission index is the pounds of nitrogen oxides produced per 1000 pounds of fuel used. This report used nitrogen oxides emissions data furnished by the Naval Air Propulsion Center and F404-GE-400 engine run sheets from NAS Lemoore. The weight of nitrogen oxides produced varied from 50 to 169 pounds per test. The amount of nitrogen oxides for each pound of fuel used varied form 0.01331 to 0.01742 pounds, with an average of 0.01556 pounds. This average can be used as a correlation coefficient to estimate the amount of nitrogen oxides produced during an engine test on the basis of total fuel use only. To estimate the total weight of nitrogen oxides, multiply the weight of fuel used in the test by 0.01556. Based on 13 engine test analyzed, the percentage difference between the amount of nitrogen oxides calculated from the emission indexes and correlation coefficient, varied from -11 to +17. The total amount of nitrogen oxides calculated using this coefficient agreed within 1% of the total amount calculated from the emission indexes. Axial flow fans.

45238 (AD-A–220920/3/XAB) **Gaseous emissions from aircraft engines. A handbook for the calculation of emission indexes and gaseous emissions from aircraft engines.** Naval Air Rework Facility, North Island, CA (USA). Aircraft Environmental Support Office. Sep 1987. 311p. (AESO–1-87). Source: NTIS, PC A14/MF A02.

For test cells, regional and state air pollution control agencies require that naval air installations obtain first, a permit to construct, and then a permit to operate. To apply for permits, personnel responsible for operating the test cells need to know the amounts of gaseous and particulate emissions formed during engine testing. This handbook shows how to estimate the gaseous emissions of carbon monoxide, oxides of nitrogen and hydro carbons formed during the operation of gas turbine engines. For each power setting of the engine, the estimation of total emissions needs: (1) a ratio of the contaminant formed to the amount of fuel used (the so-called emission index); (2) the duration of the operation; and (3) the fuel flow rate. Of these, the emission index is the most difficult to find. This handbook furnishes summary tables of representative emission indexes, at various power settings, for the gas turbine engines most likely to be operated at naval air installations. These tables also include fuel flow rates. Thus, anyone knowing the duration of the power settings can estimate the total gaseous emissions from various aircraft engines. The discussion of the emission index includes instructions on how to calculate it using both computers and small programmable calculators.

45239 (AD-A–221074/8/XAB) **Field evaluation of a passive sampling device for hydrazines in ambient air. Memorandum report.** Taffe, P.A.; Brown, S.W.; Thurow, A.R.; Travis, J.C.; Rose-Pehrsson, S.L. Naval Research Lab., Washington, DC (USA). 6 Apr 1990. 93p. (NRL-MR–6613). Source: NTIS, PC A05/MF A01.

A passive sample-dosimeter has been developed for evaluating part-per billion (ppb) levels of hydrazine and monomethyl hydrazine (MMH) in ambient air. It is designed for quantitative documentation of personnel exposures as well as ambient atmosphere concentration. It has undergone extensive laboratory and field evaluations. The laboratory tests are reviewed in this report. Tests were conducted in controlled atmospheres to evaluate the following performance parameters: collection rate, face velocity, relative humidity effects, sample stability, reproducibility, linearity, and interference effects of selected chemical vapors. Field tests were conducted to evaluate performance under typical anticipated conditions. The test locations were selected to provide information on the probable interferents. A double-bind protocol was used which involved three groups: industrial hygienists; analytical chemists; and auditors. The data obtained from the field evaluation disclosed a performance problem not encountered in the laboratory. The cause was identified and the prototype system was modified and re-tested. The results from the modified sampler indicate that it is suitable for work place monitoring applications with two minor interferents: tobacco smoke and intense direct sunlight.

45240 (AD-A–221752/9/XAB) **Comparison of steady-state evaporation models for toxic chemical spills: Development of a new evaporation model. Environmental research papers.** Vossler, T.L. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 29 Nov 1989. 56p. (GL-TR–89-0319). Source: NTIS, PC A04/MF A01.

The United States Air Force handles and stores a number of toxic and hazardous chemicals. Associated with this activity is the threat of accidental release. To determine the downwind threat of a spilled liquid chemical, one must estimate the evaporation rate of the spilled chemical. A steady state evaporation model is one that calculates the temperature of the spilled chemical pool based on the net energy input into the pool from all possible sources. The pool temperature is used to calculate the evaporation rate. Three steady state evaporation models are compared, and the most appropriate calculation for each energy input into the pool is identified. A new steady state evaporation model is presented based on the comparisons. Sensitivity studies are presented in support of the new model.

45241 (BCEP–90-03742) **Western and Northern Canada acid deposition/LRTAP activities annual report, 1987.** British Columbia Ministry of Environment and Parks, Victoria, BC (Canada). Apr 1988. 47p. (MICROLOG–90-03742). Source: PC Western and Northern Canada acid deposition/LRTAP activities, 2nd. Fl., 4999-98th Ave., Edmonton, AB, CAN T6B 2X3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A committee was established in 1980 by senior officials of Environment Canada and the environment ministries of British Columbia, Alberta, Saskatchewan, and Manitoba to coordinate monitoring, research, and other activities related to acid rain and the long-range transport of atmospheric pollutants (LRTAP). By 1982 the Northwest Territories also participated. The year's activity reported in this document shows progress in Western and Northern Canada toward a strategy for sound management of acid deposition. Priorities since 1985 have included monitoring of sulfate deposition, developing environmental standards to protect vulnerable ecosystems, developing mathematical models of LRTAP, measuring dry deposition of sulfate, monitoring surface water quality, documenting environmental impacts of acid deposition, and reviewing emissions control technologies. Research and monitoring activities are presented for each province and the federal government, for jointly managed programs, and for industry and institutional programs. Also included are tables listing annual sulfate

deposition at the various monitoring stations, and a glossary of acronyms and abbreviations. 1 fig., 5 tabs.

45242 (CCOE–CE03114, pp. 6.0-6.18) **Electrostatic precipitators and industry: Cost effective pollution control.** Smith, G.E. (Flakt Canada Ltd., Calgary, AB (Canada)). Canadian Committee on Electrotechnologies (Canada). [1990]. (CONF-9004237–: Electrotechnologies national conference, Calgary (Canada), 2-3 Apr 1990; CE–03114). In *Electrotechnologies and industry: A profitable partnership: Congress 90.* Source: TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN.

An outline is presented of the various types of equipment used to remove particulates and other pollutants from gases emitted by industrial plants. The principles of operation of such equipment are also described. The emphasis is on electrostatic precipitators, widely used to control pollution and recover valuable fly ash at coal-fired power plants and to recycle cement dust in cement plants. These devices are unique in that the forces separating the particulates from the gas stream are applied directly to particles themselves, hence the energy required to carry out the separation is considerably less than for other types of gas cleaners. The various configurations available, the sizing of the equipment for a particular application, and some of the latest technological advances in electrostatic precipitators are reviewed. In a discussion of the energy consumption of electrostatic precipitators, it is noted that the energy required as the particulate collection efficiency increases is approximately proportional to twice the inverse of the emission rate. Other kinds of control devices also require more energy as the efficiency increases, often at a greater rate of increase than for the electrostatic precipitator, especially in the efficiency range over 99%. 6 figs.

45243 (CONF-9002111–2) **SamTrack: A sample tracking system for environmental monitoring.** Horwedel, B.M. Oak Ridge National Lab., TN (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Data analysis and interpretation for environmental surveillance conference; Lexington, KY (USA); 5-7 Feb 1990. Order Number DE90016026. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Environmental Monitoring and Compliance Section (EMC) is responsible for the development and implementation of an environmental program to ensure compliance with all federal, state, and Department of Energy requirements for the prevention, control, and abatement of environmental pollution, monitor the adequacy of containment and effluent controls, and assess impacts of releases from ORNL facilities on the environment. Each month over 1000 samples of air, water, animals, and vegetation are collected and analyzed for contamination. A sample tracking system (SamTrack) was developed to automate the bookkeeping and report generation procedures required by EMC. SamTrack makes it possible for EMC to monitor individual samples from the time of submission to Analytical Chemistry Division (ACD) through the electronic transfer of analytical results. SamTrack dynamically maintains a sample status database. At anytime a variety of reports can be generated showing the status of samples being processed. Three basic reports reflect the status of the entire sample database: samples that have been submitted for analysis; samples that have completed analysis; and, samples with incomplete analysis. This paper presents the needs for a sample tracking system, how SamTrack addresses those needs, and future modifications that would improve the implementation of SamTrack. 4 figs.

45244 (DOE/EH/89027–H1P) **Confronting climate change: Strategies for energy research and development.** National Research Council, Washington, DC (USA). Committee on Alternative Energy Research and Development Strategies. Aug 1990. 127p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-89EH89027. Order Number DE90014848. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

Emissions of greenhouse gases (GHGs), especially from energy production and use, and their impact on global climate emerged as a major national issue in the United States during the 1980s. As a result, Congress directed the US Department of Energy (DOE) to ask the National Academy of Sciences and the National Academy of Engineering to assess the current state of research and development (R&D) in the United States in alternative energy sources, and to suggest energy R&D strategies involving roles for both the public and private sectors, should the government want to give priority to stabilizing atmospheric concentrations of GHGs. The findings and recommendations of the Committee on Alternative Energy Research and Development Strategies, appointed by the National Research Council in response to Congress's directive, are provided in this report and summarized in this chapter. The energy R&D strategies and actions recommended by the committee are structured to facilitate prudent and decisive responses by the United States, despite uncertainties regarding the effects of GHGs on global climate. 96 refs., 4 figs., 17 tabs.

45245 (DOE/ER/60397–T5) **Detection of CO_2-induced climatic change.** Wigley, T.M.L. East Anglia Univ., Norwich (UK). Climatic Research Unit. 15 Jul 1990. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60397. Order Number DE90015648. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In spite of the strong circumstantial evidence that the greenhouse effect has contributed significantly to the observed global warming, we are still unable to state unequivocally that the effect has been detected. Either we must eliminate all other possibilities, or we must identify one or more multivariate characteristics of the observed changes in climate that are unique signature of the greenhouse effect. We propose to continue earlier work in five areas: Updating, improvement and analysis of our global (land and marine) temperature data set, The development and use of multivariate techniques for the detection of greenhouse-gas-induced climatic change, The further development and use of simple transient-response climate models in order to elucidate the responses of the climate system to external and internal forcing, Validation of General Circulation Models using a variety of test statistics, and The use of regression methods to produce sub-grid-scale information from GCM output. 63 refs., 2 figs., 1 tab.

45246 (DOE/ER/60485–3) **Natural and anthropogenic climate change: Annual technical progress report, [September 1, 1989–May 15, 1990].** Gutowski, W.J. (Atmospheric and Environmental Research, Inc., Cambridge, MA (USA)); Clough, S.A.; Molnar, G.; Iacono, M.; Wang, W.-C. Atmospheric and Environmental Research, Inc., Cambridge, MA (USA). Jul 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60485. Order Number DE90015528. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report covers work on grant FG02-86ER60485 and consists of two parts: progress for the period 9/1/89–5/15/90 and the plan for the remaining period 5/16/90–8/31/90. The project includes two tasks: atmospheric radiation and improvement of climate models to evaluate the climatic effects of radiation changes. 2 refs., 3 figs.

45247 (EGG–2612) **Environmental monitoring for EG and G Idaho facilities at the Idaho National Engineering Laboratory: Annual report, 1989.** Tkachyk, J.W.; Wright, K.C.; Wilhelmsen, R.N. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1990. 96p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90014882. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

This report describes the 1989 environmental-monitoring activities of the Environmental Monitoring Unit of EG&G Idaho, Inc., at EG&G-operated facilities at the Idaho National Engineering Laboratory (INEL). The major facilities monitored include the Radioactive Waste Management Complex, the Waste Experimental Reduction Facility, the Mixed Waste Storage Facility, and two surplus facilities. Additional monitoring activities performed by Environmental Monitoring are also discussed, including drinking-water monitoring and nonradiological liquid-effluent monitoring, as well as data management. The primary purposes of monitoring are to evaluate environmental conditions and to provide and interpret data, in compliance with applicable regulations, to ensure protection of human health and the environment. This report compares 1989 environmental-monitoring data with derived concentration guides and with data from previous years. This report also presents results of sampling performed by the Radiological and Environmental Sciences Laboratory and by the United States Geological Survey. 17 refs., 49 figs., 11 tabs.

45248 (EML–522) **^{222}Rn, ^{222}Rn progeny and ^{220}Rn progeny as atmospheric tracers of air masses at the Mauno Loa Observatory.** Hutter, A.R.; George, A.C.; Maiello, M.L.; Fisenne, I.M.; Larsen, R.J.; Beck, H.L.; Wilson, F.C. USDOE Environmental Measurements Lab., New York, NY (USA). Mar 1990. 26p. Sponsored by U.S. DOE Energy Research. Order Number DE90014872. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

^{222}Rn, ^{222}Rn progeny and ^{220}Rn progeny concentrations in air were measured at the Mauna Loa Observatory (MLO) in Hawaii during March 1989 in order to investigate the feasibility of using them as atmospheric tracers to help determine local air mass flow patterns. Charcoal traps, cooled to dry ice temperatures, were used to collect ^{222}Rn, which was subsequently measured in pulse ionization chambers at the Environmental Measurements Laboratory (EML). ^{222}Rn progeny and ^{220}Rn progeny for 37 samples were measured at the Observatory by sampling high volumes of air through filters, which were counted for up to 11 h in alpha scintillation counters. Individual progeny concentrations were calculated using both least squares and maximum likelihood techniques. In general, ^{222}Rn progeny and ^{220}Rn progeny concentrations were low when free tropospheric air was present (downslope and tradewind conditions), and consistently higher when surface air from the island broke through the trade wind inversion layer (upslope conditions). The data suggest that ^{222}Rn, ^{222}Rn progeny, or ^{220}Rn progeny monitoring may provide new and useful information to help indicate the different air flow patterns present at MLO. 17 refs., 5 figs., 2 tabs.

45249 (EML–524) **Annual report of the Surface Air Sampling Program.** Larsen, R.J.; Sanderson, C.G. USDOE Environmental Measurements Lab., New York, NY (USA). Feb 1990. 120p. Sponsored by U.S. DOE Energy Research. Order Number DE90014873. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Tropospheric concentrations of radioactive debris from nuclear weapons tests are currently at or below the lower limits of detection of our analytical systems. Following the accident at the Chernobyl nuclear reactor in the USSR on April 26, 1986, fission products were detected at all sampling sites located in the Northern Hemisphere. Short-term variations in the concentrations of ^{7}Be and ^{210}Pb at sites in which weekly air filter samples are analyzed probably result from variations in meteorological factors. The data from quality assurance samples indicate that the reliability of the air filter measurements are acceptable. The gross gamma-ray activity and the monthly mean surface air concentrations of ^{7}Be, ^{95}Zr, ^{137}CS, ^{144}Ce and ^{210}Pb at sampling sites in the Surface Air Sampling Program during 1985 through 1988 are presented. The weekly mean surface air concentrations of ^{7}Be, ^{137}Cs, ^{144}Ce and ^{210}Pb are also presented for 11 sites. 2 refs., 1 fig., 27 tabs.

45250 (EML–527) **1989 intercomparison of radon progeny measurement methods and equipment in North America.** Scofield, P.; George, A.; Tu, Keng. USDOE Environmental Measurements Lab., New York, NY (USA). Mar 1990. 28p. Sponsored by U.S. DOE Energy Research. Order Number DE90014874. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At the 1989 ^{222}Rn progeny intercomparison held at the Environmental Measurements Laboratory (EML), July 10–14, 1989, grab sampling and integrating/continuous ^{222}Rn progeny methods were evaluated. Sixteen facilities participated in this intercomparison. Twelve facilities used ^{222}Rn progeny grab sampling methods, and nine facilities used integrating/continuous instruments. Eighty-eight percent of the participants reported grab sample ^{222}Rn progeny concentrations that were within 20% of the EML reference values. Good agreement between participant and EML grab-sample potential alpha energy concentrations (PAECs) was observed; 92% of the participants had PAECs within 20% of the EML values. For the integrating/continuous PAEC values determined with integrating/continuous monitors, 89% of the participants were within 20% of the EML reference values. 9 refs., 3 figs., 4 tabs.

45251 (EML–528) **The August 1988 and June 1989 radon intercomparisons at EML [Environmental Measurements Laboratory].** Fisenne, I.M.; George, A.C.; Keller, H.W. USDOE Environmental Measurements Lab., New York, NY (USA). Jun 1990. 27p. Sponsored by U.S. DOE Energy Research. Order Number DE90014875. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Environmental Measurements Laboratory hosted the fifteenth and sixteenth radon intercomparison exercises in August 1988 and June 1989. Forty-five groups including US Federal facilities, USDOE Office of Health and Environmental Research contractors, national and state laboratories and foreign institutions participated in these exercises. The results show that the majority of the participants' results were within $\pm$ of the EML value at radon concentrations of 220 and 890 Bq m^{-3}. 10 refs., 4 figs., 9 tabs.

45252 (ETDE-IT–90-06) **Automation of the control measurements of a nuclear emergency in the ENEA's research center in Saluggia, Italy.** Pirastru, E. ENEA, Saluggia (Italy). Centro Ricerche Energia. 1989. 5p. (CONF-8910111–1: International symposium on selected topics on radiation protection, Dubrovnik (Yugoslavia), 2-6 Oct 1989). Order Number DE90514460. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the international radiation protection symposium (Dubrovnik, 2-6 Oct 1989).

The ENEA (Italian Commission for Alternative Energy Sources) Nuclear Research Center of Saluggia (Vercelli, Italy) has two nuclear installations in which a criticality accident can occur: the EUREX plant for reprocessing of irradiated fuel and the IFEC plant for the fabrication of nuclear fuel. In order to minimize the effect on the population in the event of a criticality accident, rapid response is required by the automatic measurement of the radioactive cloud. This is accomplished through the employement of microcomputerized survey stations, which are run from a central calculator. This paper describes this system, now operating in the Saluggia Center. This system was designed to provide automatic meteorological data to track the cloud movement and automatic measurement of the cloud's radioactivity. The systems includes an integrated network of sensors to monitor wind speed and wind direction, air temperature, humidity, calorific radiation and air radioactivity.

45253 (ETDE-IT–90-11) **The ENEA LIDAR/DIAL facility: Contribution to subproject EUROTRAC/TESLAS.** Barbini, R.; Colao, F.; Palucci, A.; Ribezzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 2p. Order Number DE90514486. Source: NTIS (US Sales Only), PC A02.

Paper presented at the EUROTRAC symposium'90 on transformation and transport in the troposhere (Garmisch, 2-5 Apr 1990).

Short communication CARBON DIOXIDE LASERS/remote sensing; ENVIRONMENTAL MEASUREMENTS LABORATORY; EXPERIMENTAL DATA; WATER VAPOR; AIR POLLUTION; ATMOSPHERIC CHEMISTRY; ON-LINE MEASUREMENT SYSTEMS; INFRARED SPECTRA; OZONE

45254 (ETDE-IT–90-12) **First operation of the ENEA (Italy) carbon dioxide LIDAR/DIAL station.** Barbini, R.; Colao, F.; Palucci, A.; Ribezzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 5p. (CONF-900242–1: 4. OSA topical meeting on optical remote sensing of the atmosphere, Incline Village, NV (USA), 12-15 Feb 1990). Order Number DE90514487. Source: NTIS (US Sales Only), PC A02.

Paper presented at the topical meeting on optical remote sensing of the atmosphere (Incline Village, 12-15 Feb 1990).

Short communication CARBON DIOXIDE LASERS/experimental data; ENVIRONMENTAL MEASUREMENTS LABORATORY; WATER VAPOR; REMOTE SENSING; AIR POLLUTION; ATMOSPHERIC CHEMISTRY; ON-LINE MEASUREMENT SYSTEMS; INFRARED SPECTRA

45255 (ETDE-IT–90-13) **LIDAR activity of the ENEA ground based station: DIAL and Doppler measurements.** Barbini, R.; Colao, F.; D'Amato, F.; Giorgi, M.; Palucci, A.; Ribezzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 5p. (CONF-9007155–1: 15. international laser radar conference, Tomsk (USSR), 23 Jul 1990). Order Number DE90514488. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 15th international laser radar conference (Tomsk, 23-27 Jul 1990).

Short communication ITALY/carbon dioxide lasers; ITALY; DOPPLER EFFECT; EXPERIMENTAL DATA; ATMOSPHERIC CHEMISTRY; AIR POLLUTION; AEROSOL MONITORING; TELESCOPES; ENVIRONMENTAL MEASUREMENTS LABORATORY

45256 (ETDE-IT–90-15) **Remote sounding of atmospheric water vapour from the ENEA DIAL station.** Barbini, R.; Colao, F.; Palucci, A.; Ribezzo, S. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 4p. (CONF-9007155–3: 15. international laser radar conference, Tomsk (USSR), 23 Jul 1990). Order Number DE90514490. Source: NTIS (US Sales Only), PC A02.

Paper presented at the 15th international laser radar conference (Tomsk, 23-27 Jul 1990).

Short communication ENVIRONMENTAL MEASUREMENTS LABORATORY/remote sensing; INFRARED SPECTRA; CARBON DIOXIDE LASERS; ATMOSPHERIC CHEMISTRY; AIR POLLUTION; WATER VAPOR; ON-LINE MEASUREMENT SYSTEMS; OZONE

45257 (ETDE-IT–90-39) **Air concentrations and radionuclides deposition at Saluggia (North-West Italy) following the Chernobyl nuclear accident.** Spezzano, P.; Giacomelli, R. ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile. Apr 1989. 22p. Order Number DE90514515. Source: NTIS (US Sales Only), PC A03.

Published on Journal of Environmental Radioactivity.

After the Chernobyl accident, samples of air, fallout and soil were collected at Saluggia (Vercelli, North Italy). No significant differencies were found in the arrival times of the main radionuclides in air. Radioactivity in air was removed primarily by wet deposition rather than as dry fallout. For the long-life radionuclides, Sr90 and Cs137, the activity levels at Saluggia, during the month of May, were 0.19 kBq/square meter and 11.0kBq/square meter, respectively, as measured from fallout samples. A reasonable good agreement was found between ground deposition estimated from soil and fallout measurements and between measured values and those calculated from a deposition model. The most remarkable uncertainty was in the estimation of the distribution of iodine in air among particulates, elemental and organic forms, and this affected the prediction of the dry and wet contribution to the total iodine deposition.

45258 (GAO/RCED–90-25) **Air pollution uncertainty exists in radon measurements.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 51p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses radon which is a colorless, odorless gas formed by the decay of radium and uranium that has been shown to cause lung cancer. Progress has been made in ensuring the accuracy of home radon measurements. According to this report, however, radon measurements are uncertain because the ability of the devices that measure radon and the companies analyzing the devices' readings varies and homeowners may not be following EPA's recommended testing procedures. Several possible causes for the uncertainty in radon measurements are cited.

45259 (GSF-BPT–2/89) **Status report: Physico-chemical processes in the atmosphere.** Hoefken, K.D.; Selinger, H. (eds.). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. 132p. (In German). Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The individual contributions to this volume are papers that were originally planned to be read at a status seminar sponsored by 'Environmental and Climatic Research', which was scheduled for the beginning of 1989 but had then to be cancelled. In all, it contains sixteen reports on problems related to chemical processes in the atmosphere, including such topics as the sources and fate of methane, general trends of ozone behaviour, degradation of chlorinated hydrocarbons, kinetic mechanisms involved in the formation of sulfate and nitrate as reaction products and measurements of dry SO_2 depositions in forests. All the reports are individually retrievable from the database. (KW).

45260 (GSF-BPT–2/89, pp. 1-6) **Adduct formation of OH radicals and resultant reactions with O_2 and NO_x, leading to the atmospheric regeneration of OH.** Witte, F. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung (ITA), Hannover (Germany, F.R.)); Leonard, C.; Koch, R.; Schueler, P.; Zetzsch, C. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The reaction of OH with toluene was investigated at temperatures ranging from 300 to 486 K, using pulsed VUV flash-light photolysis of H_2O to generate OH ([OH]=$2x10^{10}$ cm^{-3}) as well as resonance fluorescence for its detection. In the range below 350 K the reaction was a (reversible) addition, while it was an abstraction at temperatures higher than 350 K. The binding energy released by OH in the toluene-OH adduct was determined to be (71+5) kJ/mol. The individual reactions of the benzene-OH and toluene-OH adducts with NO were examined by plotting time curves for the equilibrium concentration of OH in the presence of the aromatic substances and then determined from the increase of the OH elimination constant with reference to the concentration of NO. (orig./KW).

45261 (GSF-BPT–2/89, pp. 7-13) **Simulation of the tropospheric production of chlorine atoms with particular account being taken of the role of aerosol.** Behnke, W. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung (ITA), Hannover (Germany, F.R.)); Pfahler, G.; Zetzsch, C. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The influence that NaCl aerosol would exert in a photosmog system was investigated in a smog chamber made of 'Duran' glass. It was possible to show that under the influence of light a heterogenous formation of Cl_2 takes place on surfaces made up of HCl and O_3. After photolysis, this product leads to a degradation of the hydrocarbons by Cl atoms. (orig.).

45262 (GSF-BPT–2/89, pp. 14-19) **Measurements to assess atmospheric methane and its sources (destinations) on the basis of carbon (14C,13C) and hydrogen (D) isotopes.** Levin, I. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik); Bergamaschi, P.; Boesinger, R.; Doerr, H.; Junghans, C.; Katruff, L.; Muennich, K.O.; Bonani, G. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

It is the aim of this study to investigate the spatial and temporal variations in the concentration and isotopia of atmospheric methane as well as of its sources and destinations on the European continent. The results thus obtained are planned to be used in connection with the attempts made to draw up an overall balance of methane in the atmosphere. A survey is given of the measuring methods and values determined. (orig./KW).

45263 (GSF-BPT–2/89, pp. 38-46) **Study on the trend of ozone and the role of other meteorological parameters in this development.** Weigl, E. (Deutscher Wetterdienst, Hohenpeissenberg (Germany, F.R.). Meteorologisches Observatorium); Vandersee, W.; Wege, K.; Hartmannsgruber, R. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

At the meteorological observation station of Hohenpeissenberg (MOHp), which is run by the German Weather Bureau, measurements of atmospheric ozone (ozone just above ground level, total ozone, vertical ozone distribution) have been made since the year 1967. Owing to the detrimental effects of anthropogenic factors on the ozone layer long-range investigations into the behaviour of ozone have increasingly been gaining in importance. Series of ozone measurements carried out by the MOHp were therefore subjected to detailed statistical analysis within the scope of this research project. (orig.).

45264 (GSF-BPT–2/89, pp. 47-49) **Determination of HNO_3 in the atmosphere and development of a method for the detection**

of gaseous ammonia. Papenbrock, T. (Bochum Univ. (Germany, F.R.). Physikalische Chemie 1); Stuhl, F. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). Contract BMFT 074 3131/2. In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. ATMOSPHERIC CHEMISTRY/ nitric acid; NITRIC ACID/measuring methods; EARTH ATMOSPHERE; AMMONIA; AMMONIUM NITRATES; COMPARATIVE EVALUATIONS

45265 (GSF-BPT–2/89, pp. 50-69) **Development of methods to analyse the degradation products of chlorinated hydrocarbons in the atmosphere.** Baechmann, K. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 8 - Anorganische Chemie und Kernchemie im Edward-Zintl-Institut). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The degradation products of $CHCl_3$ and CCl_3-CH_3 include compounds like phosgene, mono-dichloroacetic acid, thrichloroacetic acid and acetylchloride. The occurrence of further chlorinated substances so far unknown cannot be ruled out. This reports describes the individual steps involved in the development of methods by which the above-mentioned products can be analysed. (orig./KW).

45266 (GSF-BPT–2/89, pp. 70-83) **Study of the kinetic mechanisms involved in the formation of sulfates and nitrates on individual aerosol particles.** Weisweiler, W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Chemische Technik). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). Contract BMFT 0704578 A5. In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

This contribution is divided into two sections. The first section reviews a number of final reports concerning a research project completed in December 1987 that had been undertaken to shed some light on the subject of 'individual particle analysis using the spot test and a scanning electron microscope'. This method of detection was used to analyse individual particles in the atmosphere. Sampling took place during different seasons of the year (in the summer and winter). The results are contrasted with each other. In the second section, a survey is given of the preliminary results of a research project into the 'kinetic mechanisms involved in the formation of sulfates and nitrates on real and synthetised aerosol particles' that is still in progress. In this connection, the objectives and experimental set-up are outlined just as well as the sampling techniques and chemical reaction facilities used. (orig./KW).

45267 (GSF-BPT–2/89, pp. 84-91) **Development of a meteorological-photochemical model to simulate the transportation, diffusion and deposition of trace amounts of gases occurring as reaction products above a complex terrain.** Jung, H.J. (Industrieanlagen-Betriebsgesellschaft mbH, Ottobrunn (Germany, F.R.)). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

For the purposes of this project, a non-hydrostatic mesoscale climate model, FITNAH III, was combined with a photochemical model so as to permit the transportation, diffusion and deposition of trace amounts of atmospheric gases above a complex terrain to be determined with reference to photolyserates and meteorological factors that varied in their temporal and spatial configurations. To achieve a simulation of photosmog situations on the lee side of overpopulated urban and industrial areas it was necessary for the chemical reaction model used to give reasonable approximations of all those constituents and reaction pathways that have a major role in the organic and anorganic chemistry of the air. Discussed are not only basic data and adequate dissolving techniques for the photochemical model used here but also the initial findings on the simulated diffusion of gases occurring in trace amounts. (orig.).

45268 (GSF-BPT–2/89, pp. 92-98) **Determination of the deposition rate of atmospheric aerosol particles in a beech and spruce forest.** Porstendoerfer, J. (Goettingen Univ. (Germany, F.R.). Zentrales Isotopenlabor); Butterweck, G.; Reineking, A. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Experimental investigations were carried out to determine the rate at which particles of trace elements occurring the atmosphere are deposited on different vegetation areas (meadows, beech and spruce forest). Account was also taken of meteorological factors (wind velocity, temperature) in a set of different circumstances. A naturally occurring radioactive aerosol, which is found in the degradation products of Rn-222 and Rn-220, was used for these investigations. If adequately sensitive measuring techniques are chosen, it is perfectly possible today not only to determine the activity-size distribution of radioactive aerosols in the atmosphere but also to directly measure the amount of activity deposited with those radioactive aerosols on the soil and plants. After a profile of radon has been established for its radioactive concentration on the ground, this can be used to determine the turbulent exchange coefficient which, in turn, provides important information about the transportation of trace elements to the soil surface. (orig.).

45269 (GSF-BPT–2/89, pp. 99-108) **Deposition of atmospheric trace elements in a spruce forest ecosystem in the 'Solling'.** Gravenhorst, G. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bioklimatologie); Waraghai, A.; Ehrhardt, O.; Ibrom, A.; Constantin, J.; Kreilein, H. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

It is the aim of these investigations to determine the amounts of sulfur and nitrogen that are transported from the atmosphere into a spruce forest in the Solling. This particular forest has been used for one of the longest series of measurements (20 years) carried out to determine the total quantity of atmospheric constituents deposited on trees. The great importance of such measurements is explained by the growing number of findings to prove that a prolonged action of acidic depositions considerably interfers with the delivery of nutrients of the roots and, thus, the entire tree, which also leads to an increased susceptibility to the detrimental effects of toxic elements. The individual pathways for such depositions, be it in the form of rain, gas, particles, fog or runoff from leaves, are quantified separately and independently of each other. (orig./KW).

45270 (GSF-BPT–2/89, pp. 20-29) **Formation and transformation of biogenic sulfur compounds - determination of dimethylsulfide, carbonylsulfide, carbon disulfide, methane sulfonate and excess sulfate in marine atmospheres.** Buergermeister, S. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Meteorologie und Geophysik); Georgii, H.W.; Ockelmann, G. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Several measuring campaigns launched during the years 1987/ 88 had the aim to determine the concentration ratios in oceanic water and marine atmospheres for three biogenic, gaseous sulfur compounds, which were dimethylsulfide (CH_3SCH_3, DMS), carbonylsulfide (COS) and carbon disulfide (CS_2). Parallel investigations were carried out into the levels of methane sulfonate ($CH_3SO_3^-$, MSA) and excess sulfate ($SO_4^=$), which are reaction products formed during the oxidation of dimethylsulfide in the atmosphere. Above the Atlantic profiles were established over an area from 50deg N to 30deg S, while the values relating to the North Sea were determined at the 'North Sea' Research Station as

well as on the Island of Sylt. The mean DMS concentration measured above the Atlantic did not exceed 30 ng S(DMS)/m^3 and thus remained considerably below that determined for the North Sea (>100 ng S(DMS)/m^3). In accordance with these observations, the North Sea also showed higher MSA concentrations, which averaged 10-30 ng S(MSA)/m^3, whereas the mean values determined for the Atlantic did not exceed 6 ng S(MSA)/m^3. The diurnal fluctuations of the DMS concentration above the Atlantic appeared to suggest that oxidation by NO_3 radicals is an important factor in the atmospheric degradation of DMS. The atmospheric concentration of COS above the Atlantic showed a steep gradient from north to south so that the mean value determined for the northern hemisphere 766 ng S(COS)/m^3 was higher by 170 ng S(COS)/m^3 as compared to that measured in the southern hemisphere. (orig./KW).

45271 (GSF-BPT–2/89, pp. 109-110) **The EURAD model - a contribution to the numerical simulation of long-distance transportation of pollutants in the troposphere.** Ebel, A. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. LONG-RANGE TRANSPORT/computerized simulation; AIR POLLUTION/long-range transport; AIR POLLUTION/deposition; EUROPE; DEPOSITION; TROPOSPHERE

45272 (GSF-BPT–2/89, pp. 111-116) **A complete cadastral map of immissions resulting from atmospheric contamination.** Jaenicke, R.; Vautz, W. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Every immission value is calculated from 54 individual measurements, which are in each case influenced by the wind's velocity and direction, the amount of precipitation, air humidity and to some extent also by the time of measurement. It is therefore quite obvious that it would be desirable to have a cadastral map of immissions based on continuous measurememnts, as these could provide much more reliable data than any such random determinations. A method is described to calculate immission fields and distributions that will fulfil those requirements. (orig./KW).

45273 (GSF-BPT–2/89, pp. 117-118) **Needles of conifers as natural collectors of organic air constituents.** Hutzinger, O. (Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Oekologische Chemie und Geochemie); Reischl, A.; Reissinger, M.; Umlauf, G. Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). Contract BMFT 07431247. In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

Needles of conifers are capable of adsorbing lipophilic organic substances that are contained in the air. It is the aim of these investigations to find out whether and to which extent the concentration of those substances on the needles could provide a clue to that in the air. (orig.).

45274 (GSF-BPT–2/89, pp. 119-124) **Determination of dry depositions of SO_2 in forests. Project phase 1. Improvements to the SO_2 detection system.** Rohbock, E. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projekttraeger Umwelt- und Klimaforschung. 1989. (In German). In *Status report: Physico-chemical processes in the atmosphere.* Order Number DE90517557. Source: NTIS (US Sales Only), PC A07/MF A01.

The dry deposition of SO_2 is to be measured applying the method of eddie-correlation with an uv detection system in form of a multiple reflexion cell (MRZ) designed in White configuration. During the 1st part of the project the quality of an existing MRZ is to improved and its features should be demonstrated. The improvements of construction enlarged the optical length of the cavity from 100 m to approx. 200 m and increased the mechanical and thermal stability of the system as well as the intensity of the transmitted UV light. (orig.).

45275 (IAEA-TECDOC–529, pp. 157-167) **Automatic environment monitoring of nuclear power plants with options of an expert system.** Ovcharov, R. (Energoproekt, Sofia (Bulgaria)); Shervashidze, N.; Surtmadzhiev, A. International Atomic Energy Agency, Vienna (Austria). Oct 1989. (CONF-8811331–: Technical committee on user requirements for decision support systems, Vienna (Austria), 28 Nov 1988). In *User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90637030. Source: NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS.

The currently developed computerized system for environment monitoring around Kozlodui nuclear power plant (1660 MW current installed capacity, 1000 MW in construction) designed hierarchically in two levels and covering a total of 10 monitoring stations at and outside NPP's site to monitor releases into the atmosphere, 6 stations for waste water collection, 2 weather stations and a master station for gathering, storing and processing of information is briefly outlined. The construction of a second (out-of-plant) station where all information received in NPP's main information station will be duplicated is forthcoming. Based on this decision, the conceptual issues of data gathering, transfer and processing in similar systems are discussed. The need to build special towers to measure air temperature and humidity up to 110 m in height in order to categorize atmospheric stability conditions as recommended by IAEA's Safety Guide N 86/1987 is disputable. Brief information is also provided for some works planned in Bulgaria and development of expert systems for nuclear power plants. (author). 3 refs, 3 figs.

45276 (ISI-B–2-90) **Chances and scale of reducing emissions of air pollution by new environmental protection technologies. Final report.** Angerer, G.; Boehm, E.; Schoen, M.; Toetsch, W.; Kalb, H.; Sordo, M. Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Jan 1990. 241p. (In German). Contract BMFT 01ZH8709. Order Number DE90517429. Source: NTIS (US Sales Only), PC A11/MF A01.

Up till now, systematic analysis and periodic recording of air pollutant emissions has only been carried out for SO_2, NO_x, CO, dust and the totality of volatile organic compounds (VOC). The aim of this work was to show, particularly for the other important pollutants, the extent to which emissions could be cut down using the currently available technologies, and to identify those pollutant substances and emission sources which presently still have deficits in combating air pollution by technology means. For this purpose estimates were made for the selected pollutants of the emission residues which would remain if the best technology were applied wherever this was technically feasible and reasonable. These residual emission estimates were used as indicators to evaluate the efficiency of technologies developed in the past. In the present survey it was not possible to gather original primary data; an analysis was made of the available literature. An attempt was made, by means of interviews and assessments, to minimize uncertainties and bridge the gap between frequently widely diverging data. The results show that in future the main substances to concentrate on when combating air pollution with new environmental protection technologies are the volatile organic compounds, including CFCs and solvents, the highly toxic trace pollutants such as dioxines, furanes and polycyclic aromatic hydrocarbons, and those heavy meatals which are also emitted in considerable quantity in the form of vapours. The latter category includes mercury and arsenic. The development of new environmental protection technologies should increasingly involve medium sized and small plants, which for various pollutants are responsible for a substantial proportion of total emissions. (orig.) With 298 refs., 62 tabs., 12 figs.

45277 (KFK-PEF–66) **Information system for environmental technologies.** Hackenberg, D. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Industriebetriebslehre und Industrielle Produktion); Hillenbrand, R.; Rentz, O. Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF). May 1990. 302p. (In German). Contract PEF 87/002/4. Order Number DE90517430. Source: NTIS (US Sales Only), PC A14/MF A01.

For documentation, analysis and application of the state of the art and its development an information system for pollution control techniques is being conceived using modern information and communication techniques. This report covers the pilot phase of the project, in which in cooperation with the established working party (industry, host and authorities) a test data bank is implemented including especially emission control technologies for small and medium-sized combustion systems and focussing on the practical operational experience of installed emission control systems. For the model description of the emission control technologies into the data bank a special conceptual scheme was developed. Moreover a user structure system is shown, which allows efficient access to the information without using a special search language. (orig.) With 94 figs., 15 tabs., 253 refs.

45278 (PB–86-155033/XAB) **Development of CBM-X mechanisms for urban and regional aqsms. Final report, July 1982-October 1985.** Whitten, G.Z.; Gery, M.W. Systems Applications, Inc., San Rafael, CA (USA). Feb 1986. 170p. Source: NTIS, PC A08/MF A01.

A series of chemical kinetic mechanisms, each of which describes the formation of photochemical smog from nitrogen oxide and multiple organic precursors has been developed. The most condensed version of the mechanism series now available is known as CBM-IV (Carbon Bond Mechanisms). The formulation and testing of CBM-IV is the subject of the report. This mechanism has been carefully tested against results obtained with an expanded CBM mechanism and several intermediately condensed mechanisms to ensure that the condensation steps did not contain compensating factors and to verify that the CBM-IV performed well under a range of conditions. The condensation of the expanded mechanism was tested in an incremental manner by simulating seven days of outdoor smog chamber data from two different experimental facilities. The data provided a wide range of time, temperature, light intensity, and concentration conditions for comparing simulation results from increasingly condensed mechanisms with the expanded mechanism. This approach was used to minimize compensating errors and to verify the operating boundaries of the mechanism at each condensation step. This development yielded a mechanism containing 28 species and 70 reactions.

45279 (PB–90-213893/XAB) **DEGADIS (dense gas dispersion) model, Version 2.1. User's guide.** Spicer, T.O.; Havens, J.A. PEI Associates, Inc., Cincinnati, OH (USA). Nov 1989. 427p. Source: NTIS, PC A19/MF A03.

For system on diskette, see PB–90-502253.

An improved Jet-Plume model has been interfaced with DEGADIS to provide for prediction of the trajectory and dilution of elevated dense gas jets to ground contact. DEGADIS predicts the ensuing ground-level plume dispersion. The Jet-Plume model provides for: automatic adjustment of integration step-size (using the Runge-Kutta-Gill method as in DEGADIS); elliptical plume shape (cross-section), with air entrainment specified consistent with the Pasquill-Gifford plume dispersion coefficient representation of atmospheric turbulent entrainment; user specification of averaging time; ground reflection when the plume (lower) boundary reaches ground level; and application to scenarios where the plume remains aloft.

45280 (PB–90-215203/XAB) **Fugitive Dust Model (FDM) user's guide (revised). Volume 1. User's Instructions. Final report.** Winges, K.D. TRC Environmental Consultants, Inc., Mountainlake Terrace, WA (USA). May 1990. 172p. Source: NTIS, PC A08/MF A01.

For system on diskette, see PB–90-502410.

This document provides a technical description and user's instructions for the Fugitive Dust Model (FDM). FDM is a computerized Gaussian-plume air quality dispersion model, specifically designed for estimation of concentrations and deposition impacts from fugitive dust sources. The sources may be point, line, or area sources. FDM employs an advanced gradient-transfer particle deposition algorithm. Gravitational settling velocity and deposition velocity are calculated by FDM for each of up to 20 user-specified particle size classes. Descriptions of three performance evaluations of FDM and the EPA Industrial Source Complex model are included in an appendix. Also included with the manual is a floppy diskette containing FORTRAN source codes, PC executable codes, and test data sets.

45281 (PB–90-221870/XAB) **Atmospheric sciences research in the US EPA climate program.** Finkelstein, P.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. 1990. 21p. (EPA–600/D-90/029). Source: NTIS, PC A03/MF A01.

The program is designed to assess, evaluate, and predict the ecological, environmental, and human health consequences of global change, including the interaction of plant and animal communities with the climate system. Additional supporting areas of research in the program include: assessment and research to develop techniques to mitigate and adapt to climate change; development of emission factors and chemical models to understand and describe the production, transport, and fate of radiatively important trace gases; and evaluation of the relationship between global climate change and changes in regional climate and air quality. The paper reviews the research agenda, with emphasis on the atmospheric chemistry and climatological aspects of the program.

45282 (PB–90-221896/XAB) **Evaluation of HC1 measurement techniques at municipal and hazardous-waste incinerators.** Shanklin, S.A.; Steinsberger, S.C.; Logan, T.J.; Rollins, R. Entropy Environmentalists, Inc., Research Triangle Park, NC (USA). 1990. 16p. Source: NTIS, PC A03/MF A01.

Hydrogen chloride (HC1) emissions from hazardous waste incinerators are regulated by the EPA, and the Agency is considering HC1 regulations for municipal waste combustors. Until recently, techniques to adequately quantify these emissions using either instrumentation or wet-chemistry sampling methods have not been evaluated. The EPA has sponsored several field tests to assess the performance of commercially-available HC1 continuous emission monitoring systems (CEMS's) and a proposed manual sampling and analysis methodology for use at municipal and hazardous waste incinerators. Tests were performed (1) to determine the capability of HC1 CEMS's to provide valid measurement data, (2) to develop HC1 CEMS performance specifications, and (3) to develop a suitable performance test method.

45283 (PB–90-221904/XAB) **Carbon monoxide and total-hydrocarbon continuous monitoring at hazardous-waste incineration facilities.** Cone, L.; Logan, T.; Rollins, R. Entropy Environmentalists, Inc., Research Triangle Park, NC (USA). Nov 1989. 14p. Source: NTIS, PC A03/MF A01.

Incineration is being viewed increasingly as the most practical, least harmful means of disposing of hazardous waste. The EPA has recently proposed continuous monitoring specifications and regulatory requirements which expand those established in 40 CFR Part 264, Subpart 0, and the associated permit rules of 40 CFR Part 270. The regulations are intended to provide additional assurance that the operation of hazardous waste incineration facilities does not pose unacceptable risk to public health. In support of these regulations, commercially-available carbon monoxide (CO) and total hydrocarbon (THC) continuous emissions monitors are being evaluated. Laboratory performance tests were conducted to determine characteristics such as calibration drift, linearity, and response time. Carbon dioxide interference in CO measurements and hydrocarbon instrument sensitivity to various hydrocarbons were also investigated. A field evaluation was conducted at a hazardous waste incinerator.

45284 (PB–90-221912/XAB) **US Environmental Protection Agency's model for complex-terrain applications.** Perry, S.G.; Finkelstein, P.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. 1990. 8p. (EPA–600/D-90/034). Source: NTIS, PC A02/MF A01.

The Complex Terrain Dispersion (CTDMPLUS), a point-source, steady-state, dispersion model for complex terrain applications, is described and its performance summarized. The model is unique in the manner in which it simulates the flow and plume distortion near the terrain. Emphasis is given to windward side impacts. Simplicity is maintained by applying flow distortion corrections to flat-terrain, Gaussian and bi-Gaussian pollutant distributions. The performance of CTDMPLUS contrasts with that of a currently-recommended, complex-terrain, regulatory model. In stable or neutral conditions, CTDMPLUS shows relatively small average bias compared to field observations. The root-mean-square differences between CTDMPLUS and the observations are consistently lower and the percent of predictions within a factor of two are significantly higher than those of the regulatory model. In convective conditions, with comparisons unpaired in time or space, CTDMPLUS performs very well.

45285 (PB–90-221920/XAB) **Nested-grid modeling approach for assessing urban ozone air quality.** Rao, S.T.; Sistla, G.; Ku, J.Y.; Scheffe, R.D.; Schere, K.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Jun 1989. 29p. (EPA–600/D-90/035). Source: NTIS, PC A03/MF A01.

The paper describes an effort to interface the modeled concentrations and other outputs of the Regional Oxidant Model (ROM) as an alternative set of input files to apply in Urban Airshed Model (UAM) simulations. Five different days exhibiting high ozone concentrations during the 1980 ozone season were simulated by the UAM for the New York metropolitan area for a base scenario and for different sets of initial and boundary conditions and winds from the ROM. The methodology of integrating the ROM results into the UAM processor system is discussed. The modeled UAM ozone concentrations are compared with measured values for the various model input data scenarios in assessing the performance of the nested grid modeling approach.

45286 (PB–90-222126/XAB) **Geophysical Monitoring for Climatic Change Number 17. Summary report, 1988.** Elkins, J.W.; Rosson, R.M. National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab. Dec 1989. 152p. Source: NTIS, PC A08/MF A01.

See also report for 1987, PB–89-159628.

The contents of this study include: observatory reports; aerosols and radiation monitoring group; carbon cycle group; ozone group; acquisition and data management group; air quality group; nitrous oxide and halocarbons group; director's office; and cooperative programs.

45287 (PB–90-222696/XAB) **Economic assessment of materials damage in the South Coast Air Basin: A case study of acid-deposition effects on painted wood surfaces using individual maintenance-behavior data.** Horst, R.L.; Zankel, K.; Kamen, S.; Rosso, D. Mathtech, Inc., Princeton, NJ (USA). May 1990. 238p. (REPT–3122). Source: NTIS, PC A11/MF A02.

The case study examines the economic impact of acid deposition damage to painted wood surfaces in the South Coast Air Basin of Southern California. The output of the analysis is an estimate of the annual cost-savings that would be realized for a uniform 10 percent reduction in NO2 concentrations. The economic estimates are developed for individuals who reside in single family homes, make their own maintenance decisions, and perform one of six specific maintenance tasks. Individual maintenance behavior data are collected as part of the study and permit a more disaggregate analysis than earlier economic materials damage assessments. The economic estimates are derived in two ways. First, physical damage functions are used to predict rates of damage. The analysis indicates that the best estimates of annual cost-savings for the scenario examined are $0.7 million (1988) for the physical damage function approach and $3.6 million (1988) for the economic damage function approach. Consideration of some of the factors that contribute to uncertainty indicate that the cost-savings estimates could vary by at least a factor of two.

45288 (PB–90-222704/XAB) **Testing of indoor radon reduction techniques in central Ohio houses: Phase 2 (Winter 1988-1989). Final report, September 1988-May 1989.** Findlay, W.O.; Robertson, A.; Scott, A.G. Acres International Corp., Amherst, NY (USA). May 1990. 299p. Source: NTIS, PC A13/MF A02.

See also PB–89-219984.

The report gives results of tests of developmental indoor radon reduction techniques in nine slab-on-grade and four crawl-space houses near Dayton, Ohio. The slab-on-grade tests indicated that, when there is a good layer of aggregate under the slab, the sub-slab ventilation (SSV) mitigation technique, with only one or two suction pipes, can generally reduce indoor concentrations below 2 pCi/L (86 to 99% reduction). These reductions can be achieved even when: there are forced-air supply ducts under the slab; the slab is large (up to 2600 sq ft); and the foundation walls are hollow block. Operating the SSV system in suction always gave greater reductions than did operating in pressure. The crawl-space tests demonstrated that depressurizing under a plastic liner over the crawl-space floor was able to reduce living-area radon concentrations below 2 pCi/L (81 to 96% reduction). The performance of such sub-liner depressurization gave better reductions than did crawl-space ventilation (blowing air into, or out of, the crawl space). Completely covering the crawl-space floor with plastic sheeting was not always necessary to get adequate performance.

45289 (PB–90-225293/XAB) **Evaluation of the regional oxidant model (Version 2.1) using ambient and diagnostic simulations. Interim report, January 1989-April 1990.** Pierce, T.E.; Schere, K.L.; Doll, D.C.; Heilman, W.E. Computer Sciences Corp., Research Triangle Park, NC (USA). Apr 1990. 112p. Source: NTIS, PC A06/MF A01.

The latest version of EPA's Regional Oxidant Model, ROM2.1 was evaluated to determine and to document its accuracy. In this evaluation, model estimates were compared with ambient measurements of hourly surface ozone collected on 26 days during the summer of 1985 in the northeastern United States. The observed and modeled maximum daytime concentrations agreed on average within 2 ppb (79 ppb versus 77 ppb), but the model tended to underestimate the concentrations at the higher extremes of the frequency distribution, particularly in the southern and western portions of the model domain. Estimated and observed spatial patterns for three day maximum ozone generally showed good agreement. ROM2.1 improved noticeably over ROM2.0 with regard to the orientation of the high-ozone plumes in the Northeast Corridor. A unique aspect of the ambient evaluation was an assessment of the model's ability to estimate boundary conditions for the Urban Airshed Model. Near New York City, estimated and observed boundary conditions agreed to within 4 ppb (57 ppb versus 61 ppb). Model performance degraded, however, during some situations with dynamic mesoscale wind flow conditions. A series of diagnostic tests was also done on ROM2.1 to investigate the accuracy of its numerical solution algorithms. When the model was subjected to extremely steep concentration gradients (steeper than those observed in the ambient atmosphere), the model did not conserve mass during a 48 h simulation, deviating by as much as 18% from the initialized value. However, tests with a mass-corrected version of the full simulation model showed that predicted ozone values deviated only slightly (less than 4%) from the original model.

45290 (PB–90-226614/XAB) **Locating and estimating air-toxics emissions from sewage-sludge incinerators. Final report, March-November 1989.** Lamb, L.; Brickley, C.B.; Dykes, R. Radian Corp., Research Triangle Park, NC (USA). May 1990. 83p. Source: NTIS, PC A05/MF A01.

The document is intended to assist groups interested in inventorying air emissions of various potentially toxic substances from sewage sludge incinerators. Its intended audience includes Federal, State and local air pollution personnel. The document presents information on the process description of the various types of sewage sludge incinerators and their air pollution control equipment. Emission factors are presented for each major type of sewage sludge incinerators for the following: metals including arsenics, beryllium, cadmium, chromium, and nickel; and organics including chlorinated dibenzo-p-dioxins, dibenzofurans, benzene, chlorinated benzene, and phenol.

45291 (PB–90-228610/XAB) **Available models for estimating emissions resulting from bioremediation processes: A**

review. Final report. Sharp-Hansen, S. AQUA TERRA Consultants, Mountain View, CA (USA). Mar 1990. 275p. Source: NTIS, PC A12/MF A02.

The use of bioremediation processes to treat hazardous waste has increased in the last 10 years. Biological treatment offers the advantage of contaminant destruction rather than transfer to other media. There is concern, however, that significant amounts of organic pollutants are emitted to the air from biological treatment activities before they can be degraded. To estimate the magnitude of emissions from these facilities, overall fate models that incorporate the effects of several competing removal mechanisms are needed. The report focuses on the state-of-the-art in modeling air emissions from bioremediation processes. The biological treatment systems are described, as are the important pathways that affect the fate of organic pollutants in those systems. Currently available models are identified, described, and evaluated for each bioremediation process. Finally, some limitations of the models and the need for additional research are discussed.

45292 (PB–90-228628/XAB) **Calendar year 1985-87 solar and weather data for Austin, Texas. Research report.** Vliet, G.C.; Hadjimarkos, C.; Hunn, B.D. Texas Univ., Austin, TX (USA). Center for Energy Studies. Jan 1989. 69p. Source: NTIS, PC A04/MF A01.

See also PB–87-220174.

The Center for Energy Studies (CES) and the Department of Mechanical Engineering maintain a monitoring station for solar and weather data at the University of Texas at Austin. The station has recorded solar (global horizontal, direct normal, and diffuse horizontal) and weather (wind speed and direction, dry-bulb temperature, and relative humidity) data since it became operational on July 1, 1984. A description of the monitoring station, its instrumentation, and the data acquisition and analysis procedures is given in a previous CES report. Hourly and monthly data for the calendar year 1985 are also presented in that report and are archived on the university's Cyber computer system. The present report extends the documentation of the 1985 historical data by adding data for 1986 and 1987. While the 1985 data report includes tabular hourly data for the entire year, the present report includes only the hourly average summaries by month. However, the full hourly data for 1985-87 are archived on the Cyber system.

45293 (PB–90-228826/XAB) **Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company refuse-derived-fuel facility, Biddeford, Maine.** Midwest Research Inst., Kansas City, MO (USA). Jul 1989. 1358p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-228834 through PB–90-228859.

A separate abstract is included for each of the 3 volumes of this set.

45294 (PB–90-229782/XAB) **Acid deposition in Maryland: Summary of results through 1989. Final report.** DeMuro, J.; Bowman, M.; Maxwell, C.; Asante-Duah, D.; Meyers, S. Maryland Dept. of Natural Resources, Annapolis, MD (USA). Chesapeake Bay Research and Monitoring Div. Jun 1990. 111p. (CBRM-AD–90-4). Source: NTIS, PC A06/MF A01.

See also PB–89-182729.

The Chesapeake Bay Research and Monitoring Program coordinates Maryland's acid deposition research and reports research results annually. The report evaluates several major topic areas including transport and chemistry of acid deposition, its potential impacts on the State's streams and fish, possible impacts on terrestrial resources such as crops and forests and on materials, the ability of energy conservation programs to reduce emissions of acid-forming pollutants, and mitigation techniques for neutralizing acid waters.

45295 (PB–90-231259/XAB) **Extent and magnitude of recent changes in forest condition and the role of air pollution and non-air pollution factors.** Reams, G.A.; Vong, R.J.; Bohm, M.; Mattson, K.G.; Arnaut, L.Y. Oregon State Univ., Corvallis, OR (USA). May 1990. 156p. Source: NTIS, PC A08/MF A01.

The Forest Response Program (FRP) is a research initiative under Task Group V of the National Acid Precipitation Assessment Program (NAPAP). In response to reports of forest decline, the FRP was established to estimate actual and potential effects of acid deposition and its associated pollutants on trees, forests and forest ecosystems in the regions of the United States. The purpose of the document is to synthesize research on: changes in forest condition greater than can be attributed to natural variability; and spatial patterns existing in forest condition ions and their relation to spatial patterns of exposure.

45296 (PB–90-231358/XAB) **IMPROVE progress report.** Pitchford, M.; Joseph, D. Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab. May 1990. 36p. (EPA–450/4-90/008). Source: NTIS, PC A03/MF A01.

See also PB–90-231374.

In consideration of the requirements of the Section 169A of the Clean Air Act of 1977, the objectives of the IMPROVE program are–to establish the background visibility levels necessary to assess impacts of potential new sources, to determine the sources and levels of reasonably attributable visibility impairment, to collect data useful for assessing progress toward the national visibility goal, and to promote the development of improved visibility monitoring technology and the collection of comparable visibility data. In order to meet these objectives two distinct monitoring activities were developed and initiated. The report summarizes the progress made to date in developing and implementing the IMPROVE monitoring network. Section II addresses the background monitoring network and Section III reviews the impairment attribution monitoring efforts.

45297 (PB–90-231374/XAB) **IMPROVE progress report, Appendices B-H.** Pitchford, M.; Joseph, D. Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab. May 1990. 302p. (EPA–450/4-90/008B). Source: NTIS, PC A14/MF A02.

See also PB–90-231358.

In Section 169A of the Clean Air Act as amended August 1977, Congress declared as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution. Mandatory class I Federal areas are national parks greater in size than 6000 acres, wilderness areas greater in size than 5000 acres and international parks that were in existence on August 7, 1977. This section required the Environmental Protection Agency (EPA) to promulgate regulations requiring States to develop programs in their State Implementation Plans (SIPs) providing for visibility protection in these areas. EPA promulgated these regulations on December 2, 1980. The report summarizes the progress made to date in developing and implementing the interagency monitoring network which supports the effort, Interagency Monitoring of Protected Visual Environments (IMPROVE).

45298 (PB–90-231929/XAB) **Mineralogical characterization of the Shelburne Marble and the Salem limestone: Test stones used to study the effects of acid rain.** McGee, E.S. Geological Survey, Alexandria, VA (USA). 1989. 32p. (USGS-BULL–1889). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.; Library of Congress catalog card No. 89-600193.

The Salem Limestone and the Shelburne Marble are representative of limestones and marbles commonly used in buildings and monuments. Both stones are composed predominantly of calcite. The Salem Limestone is homogeneous in composition and mineralogic characteristics throughout the test block. The Shelburne Marble has compositionally homogeneous mineral phases, but the distribution of those phases within the test block is random. The mineralogy and physical characteristics of the Shelburne Marble and Salem Limestone test blocks described in the study provide a baseline for future studies of the weathering behavior of these stones. Because the Shelburne Marble and the Salem Limestone are representative of typical commercial marbles and limestones, they are likely to be useful in a consortium study of the effects of acid precipitation on these two types of building stones.

45299 (PB–90-232281/XAB) **Implications of global climate change for Western agriculture.** Adams, R.M.; McCarl, B.A.; Dudek, D.J.; Glyer, J.D. Oregon State Univ., Corvallis, OR (USA). ©1988. 11p. Source: NTIS, PC A03/MF A01.

Pub. in Western Jnl. of Agricultural Economic, Vol. 13, No. 2, 348-356(1988).

Global climate change from increases in atmospheric carbon dioxide and other trace gases is an issue of international concern. Adverse climatic conditions are expected to reduce crop yields and alter the demand for and supply of water. These potential adjustments imply economic costs to agriculture and its constituents. The paper explores possible economic implications for U.S. agriculture, with particular reference to the West. Results from a series of spatial equilibrium model analyses suggest that climate change is not a food security issue for the United States. However, regional adjustments in agricultural production and associated resource use are expected.

45300 (PB–90-232323/XAB) **Canopy reflectance of soybean as affected by chronic doses of ozone in open-top field chambers.** Cure, W.E.; Nusser, S.M.; Heagle, A.S. North Carolina State Univ., Raleigh, NC (USA). ©1988. 8p. Source: NTIS, PC A02/MF A01.

Pub. in Photogrammetric Engineering and Remote Sensing, Vol. 54, 499-504(1988).

The relationship between canopy reflectance and ozone (O3) treatment was investigated in a field experiment with soybean growing in 3-m diameter, 2.4-m high open-top exposure chambers. The objectives were to develop an understanding of the pattern of reflectance changes induced by this air pollutant and to investigate how the changes might ultimately be related to yield. Correlations were obtained between the reflectance data and visual estimates of non-green leaf area, a widely-used technique for rating pollutant injury. Analysis of reflectance spectra taken in early September, early October, and mid-October showed O3 treatments to be highly correlated with reflectances at visible wavelengths and at near-infrared wavelengths up to about 720 nm. Early leaf senescence caused by O3 was easily measured by reflectance changes.

45301 (PB–90-233180/XAB) **Quantifying foliar responses of white ash to ozone and simulated acid precipitation: An assessment proposal for forest exposure studies. Forest Service research paper. (Final).** Dochinger, L.S.; Jensen, K.F. Forest Service, Delaware, OH (USA). Northeastern Forest Experiment Station. Apr 1990. 8p. (FSRP-NE–641). Source: NTIS, PC A02/MF A01.

Seedlings populations represent an important linkage for assessing the effect of air pollution on forests. The study examines the foliar responses of white ash seedlings to ozone and acid precipitation as a means of identifying atmospheric deposition effects on forests.

45302 (PB–90-233727/XAB) **NIOSH testimony on indoor air quality: Selected references before the Subcommittee on Superfund, Ocean and Water Protection, Committee on Environment and Public Works, United States Senate by J. Donald Millar, May 26, 1989.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Standards Development and Technology Transfer. Sep 1989. 61p. Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

The National Institute for Occupational Safety and Health (NIOSH) has compiled the document in response to an increasing number of requests for information about indoor air quality (IAQ), including sick building syndrome. Included in the publication are: NIOSH Congressional testimony that describes the NIOSH IAQ investigations program and summarizes the results of NIOSH research and findings on IAQ problems, NIOSH guidance for conducting indoor air quality investigations, NIOSH journal article on evaluating building ventilation systems, and list of non-NIOSH publications on indoor air quality. As the Federal agency responsible for conducting research and making recommendations for occupational safety and health standards, NIOSH limits its IAQ activities to the occupational environment. The U.S. Environmental Protection Agency (EPA) also conducts an IAQ program and can be contacted for information regarding both occupational and non-occupational settings.

45303 (PB–90-235094/XAB) **Development and selection of ammonia emission factors for the 1985 NAPAP emissions inventory. Final report, August 1987-December 1989.** Warn, T.E.; Zelmanowitz, S.; Saeger, M. Alliance Technologies Corp., Chapel Hill, NC (USA). Jun 1990. 57p. Source: NTIS, PC A04/MF A01.

The report, prepared for the National Acid Precipitation Assessment Program (NAPAP), identifies the most appropriate ammonia (NH_3) emission factors available for inclusion in the 1985 NAPAP Emissions Inventory. NH_3 emission factors developed for several new NAPAP source categories were compared with factors developed for other inventories. Although many of the NH_3 emission factors presented in the report have low quality ratings, those factors determined to be the most accurate for each category were selected for application to the Inventory. Emissions factors and estimates of NH_3 emissions are included for human breath, cigarette smoke, and human perspiration but, for reasons discussed, are not included in the Inventory. NH_3 emissions from wildlife excrement were investigated; while there is not universal agreement, the report and other NAPAP research conclude that the net contribution to ambient NH3 is zero. The total NH_3 emissions included in the Inventory are 1,685,473 tons per year. The most significant NH_3 sources, accounting for 83% of the total emissions, were livestock wastes, wastewater treatment, and ammonium nitrate manufacture.

45304 (PB–90-235714/XAB) **Variability of I/M test scores over time.** Smith, L.R. Southwest Research Inst., San Antonio, TX (USA). Sep 1988. 213p. Source: NTIS, PC A10/MF A02.

The program involved conducting twice-weekly I/M (Inspection and Maintenance) emission short tests on twenty-five late model gasoline-fueled vehicles over a 15-week time period. All of the twenty-five vehicles (1981 model year or later) were tested once in the morning and again later that same day following a soak period of at least three hours. The vehicles tested in the program were owned by Southwest Research Institute employees and were selected to represent a variety of vehicle types, emission controls, etc. Emission tests were conducted using two Bear Automotive Type 42-925 4-Gas Infrared Analyzers with generic software. Each emission test sequence included a Test Analyzer Specifications (TAS) sequence (i.e., 2500 rpm/idle test with emissions measured in both modes), a vehicle conditioning step utilizing three minutes of engine operation at 2500 + or - 300 rpm with the vehicle transmission in neutral, idling in neutral for 15 seconds, and finally a second TAS sequence. The tests were conducted to provide EPA with information regarding variability in short test emission results, impact of off-idle no-load preconditioning cycles on short test emissions, and emission differences between a fully-warmed vehicle and a soaked vehicle having undergone minimum operation. Hydrocarbon and carbon monoxide emissions are reported for each vehicle in tabular and graphical form. Hydrocarbons are reported in ppm and carbon monoxide in percent.

45305 (PB–90-235789/XAB) **Development of a sampling procedure for large nitrogen- and sulfur-bearing aerosols.** Randtke, S.J.; Lane, D.D.; Baxter, T.E. Kansas Univ., Lawrence, KS (USA). Dept. of Civil Engineering. Jun 1990. 124p. Source: NTIS, PC A06/MF A01.

So that reliable estimates of the loads of nitrogen and sulfur associated with dry deposition can be made, scientists at the U.S. EPA and elsewhere have been working to develop quantitative methods to sample and analyze the major nitrogen- and sulfur-containing species present in gaseous and aerosol form in ambient air. The objective of the research investigation was to develop a sampling procedure for large aerosols that would: (1) permit accurate determination of the mass and chemical composition of large particles present in ambient air over a 24-hour period; (2) employ a device that could be used in conjunction with an annular denuder and filter pack without interference in the determination of the gaseous and fine-particle constituents; (3) avoid the formation of chemical artifacts; and (4) be simple enough to deploy in a nationwide monitoring network.

45306 (PB–90-235847/XAB) **Validation of emission test method for PCDDs and PCDFs. II.** Pau, J.C.; Romeu, A.A.; Whitacre, M.; Coates, J.T. Midwest Research Inst., Kansas City, MO (USA). Jun 1990. 61p. Source: NTIS, PC A04/MF A01.

See also PB–90-187246.

A modified EPA Method 5 (MM5) sampling train and a dynamic spiking system were used to characterize the precision and

accuracy of the collection and analysis of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzo-furans (PCDFs) in municipal-waste combustor (MWC) emissions. Isotopically labeled PCDD and PCDF compounds were dynamically spiked into the sampling train during the MWC flue gas sampling in addition to the spikes directly into the XAD-2 resin component of the MM5 sampling train just prior to sampling. The results from the study indicate that the sampling trains provide quantitative and reproducible measurements of PCDDs and PCDFs under the conditions used during the study. Accuracy of the measurements, estimated from the dynamic spiking system, ranged from 77.6% to 117%. The pooled relative standard deviations of the difference in recovery were between 5.77% to 12.3% for different compounds.

45307 (PB–90-235854/XAB) **Laboratory method to estimate hydrogen chloride emission potential before incineration of a waste. Final report.** Peterson, M.R.; Albritton, J.R.; Jayanty, R.K.M. Research Triangle Inst., Durham, NC (USA). Jul 1990. 49p. Source: NTIS, PC A03/MF A01.

A laboratory method has been developed to provide an estimate of the amount of hydrogen chloride gas that will form during incineration of a waste. The method involves incineration of a sample of the waste at 900 C in a tube furnace, removal of particles from the resulting gases by filtration at 250 F (120 C), collection of hydrogen chloride gas in a water-filled impinger, and measurement of the collected HCl as chloride using a standard ion chromatography/conductimetric detection method. Duplicate experimental runs were conducted with quartz and with INCONEL components in the incineration zone of the apparatus. The two materials gave quite different results, which indicates some surface phenomenon may be involved. Results with quartz components indicated that organochlorine is essentially completely converted to HCl. Very ionic inorganic chlorides (e.g., KCl and NaCl) formed little or no HCl when incinerated in zero grade air (3ppm water and 1 ppm total hydrocarbon) but gave large amounts of HCl (20-80% conversion) if the incineration atmosphere contained 2.4-5.0% water vapor, which contains hydrogen for HCl formation. Results with less ionic inorganic chloride (FeCl3) and with chlorine in a positive oxidation state (NaCl solution) indicated significant conversion to HCl, especially in the presence of hydrogen from water vapor. In all cases, the presence of water vapor increased the amount of HCl formed, but INCONEL was judged less suitable than quartz because INCONEL gave low recovery of organohalogen as HCl.

45308 (PB–90-235862/XAB) **Summary of the workshop on the effects of air pollutants on regional climate. Held in Rougemont, NC on January 29-February 1, 1984.** Charlson, R.J.; Wilson, W.E. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Jul 1990. 82p. (EPA–600/9-90/030). Source: NTIS, PC A05/MF A01.

A workshop was held to consider the reduction of sunlight caused by aerosols in the atmosphere in terms of the quantity of solar energy lost or redistributed and the possible significance of such a phenomena. The workshop examined possible air pollution, meteorological, and agricultural effects. Discussions within the workshop yielded a consensus on several items: (1) in the eastern United States the annual average loss of solar energy reaching the earth's surface due to aerosols is around 7%; (2) sulfate and soot-containing aerosols are the chief contributors to this effect; (3) most of these aerosols result from man-made sources and (4) measurements of the composition, concentrations, and optical properties of the haze quantitatively confirm the estimate of 7%. The workshop also confirmed that the geographical extent of loss of irradiance is roughly from the Mississippi River to the Atlantic coast and from Tennessee to southeastern Canada. This region is about 1000 km across and has an area of about 1,000,000 sq km. Recommendations for future research are given.

45309 (PB–90-235953/XAB) **Urban Airshed Model study of five cities.** Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Apr 1990. 1748p. Source: NTIS, PC EE99/MF E99.

Set includes PB–90-235961 through PB–90-236027.

A separate abstract is included for each of the 7 volumes of this set.

45310 (PB–90-235961/XAB) **Urban Airshed Model study of five cities: Volume 1. Summary report.** Scheffe, R.D. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Apr 1990. 55p. (EPA–450/4-90/006A). Source: NTIS, PC A04/MF A01.

See also Volume 2, PB–90-235979. Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The 5-City study embodied two major elements. These are (1) a demonstration of the low-cost application of the Urban Airshed Model (UAM) and, (2) the use of the model to assess peak ozone impacts in several cities (New York, St. Louis, Atlanta, Dallas-Fort Worth and Philadelphia) due to various emissions strategies. The Urban Airshed Model (UAM) is EPA's preferred model for conducting ozone air quality simulation analyses. The project is documented in the Summary Report and a set of 5 topic reports. The Summary Report condenses key material from each report and synthesizes key results and conclusions for the entire study. Reports 1 and 2 address the low-cost testing of the UAM. Reports 3-5 document the results of the emissions strategy analyses. The preliminary overview provides a synopsis of the project structure and principal findings.

45311 (PB–90-235979/XAB) **Urban Airshed Model study of five cities. Volume 2. Demonstration of low-cost application of the model to the city of Atlanta and the Dallas-Fort Worth Metroplex region.** Morris, R.E.; Myers, T.C.; Carr, E.L.; Causley, M.C. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 368p. Source: NTIS, PC A16/MF A02.

See also Volume 1, PB–90-235961 and Volume 3, PB–90-235987; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The EPA has funded a study of the Practice-for-Low-Cost-Airshed-Application-for-Nonattainment-Regions (PLANR) approach in five urban areas in the U.S. (New York, St. Louis, Atlanta, Philadelphia, and Dallas-Fort Worth). The main objectives of the Five Cities study are to demonstrate the usefulness of PLANR for air quality planning, determine the effects of alternative fuels and alternative Reid vapor pressure values for fuels on urban ozone concentrations, demonstrate the use of PLANR to evaluate SIP control strategies, and transfer the UAM model, modeling data bases, and applications technology to the states for use in future SIPs. In addition, the study includes two city-specific analyses for the St. Louis and Philadelphia areas, comparison of the PLANR use of the UAM (i.e., using only routinely available data) with applications of the UAM that use an extensive data base and the effects of biogenic emissions on anthropogenic emission reductions in the Atlanta area. The report describes the PLANR application of the UAM to the city of Atlanta and the Dallas-Fort Worth metroplex area.

45312 (PB–90-235987/XAB) **Urban Airshed Model study of five cities. Volume 3. Evaluation of base case model performance for the cities of St. Louis and Philadelphia using rich and sparse meteorological inputs.** Morris, R.E.; Myers, T.C.; Carr, E.L. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 264p. Source: NTIS, PC A12/MF A02.

See also Volume 2, PB–90-235979 and Volume 4, PB–90-235995; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The document presents Urban Airshed Modeling results for St. Louis and Philadelphia. Two sets of meteorological inputs, representing rich and sparse observed data fields, were developed for each city. Comparison simulations based on the different input approaches are presented.

45313 (PB–90-235995/XAB) **Urban Airshed Model study of five cities. Volume 4. Low-cost application of the model to Atlanta and evaluation of the effects of biogenic emissions on emission-control strategies.** Morris, R.E.; Myers, T.C.; Causley, M.C.; Gardner, L.; Carr, E.L. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 170p. Source: NTIS, PC A08/MF A01.

See also Volume 3, PB–90-235987 and Volume 5, PB–90-236001; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The document presents Urban Airshed Modeling results showing sensitivity of peak ozone to manmade hydrocarbon emissions reductions for two cases - inclusion and exclusion of biogenic emissions.

45314 (PB–90-236001/XAB) **Urban Airshed Model study of five cities. Volume 5. A low-cost application of the urban airshed model to the New York Metropolitan Area and the City of St. Louis.** Morris, R.E.; Myers, T.C.; Hogo, H.; Chinkin, L.R.; Gardner, L. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 381p. Source: NTIS, PC A17/MF A02.

See also Volume 4, PB–90-235995 and Volume 6, PB–90-236019; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The document presents Urban Airshed Modeling results for New York and St. Louis. Included are a series of emissions strategies based on Reid Vapor Pressure (RVP) reduction and alcohol/gasoline blended fuels.

45315 (PB–90-236019/XAB) **Urban Airshed Model study of five cities. Volume 6. Low-cost application of the model to future-year SIP control and alternative-fuel strategies for Dallas-Fort Worth, Atlanta, Philadelphia and St. Louis. (Volume 1: results).** Morris, R.E.; Causley, M.C.; Fieber, J.L.; Gardner, L.; Myers, T.C. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 113p. Source: NTIS, PC A06/MF A01.

See also Volume 5, PB–90-236001 and Volume 7, PB–90-236027; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The document presents Urban Airshed Model results on alternative fuel and State Implementation Plan (SIP) strategies for Atlanta, Dallas-Fort Worth, St. Louis and Philadelphia.

45316 (PB–90-236027/XAB) **Urban Airshed Model study of five cities. Volume 7. Low-cost application of the model to future-year SIP control and alternative-fuel strategies for Dallas-Fort Worth, Atlanta, Philadelphia, and St. Louis.** Morris, R.E.; Causley, M.C.; Fieber, J.L.; Gardner, L.; Myers, T.C. Systems Applications, Inc., San Rafael, CA (USA). Apr 1990. 397p. Source: NTIS, PC A17/MF A03.

See also Volume 6, PB–90-236019; Also available in set of 7 reports PC E99/MF E99, PB–90-235953.

The document provides concentration isopleths and tables in support of Volume I.

45317 (PB–90-502253/XAB) **DEGADIS (dense gas dispersion) model, Version 2.1 (for microcomputers). Model-Simulation.** Guinnup, D. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. 1989. vp. Source: NTISCP D01.

Supersedes PB–88-202379. Computer: DEC VAX. Language: FORTRAN. The program is written in FORTRAN for compilation and execution on a DEC VAX computer. Implementation on any other system may be attempted at the risk of the user. To facilitate dissemination of the model, it is being provided on diskette. The software is contained on one 360K, 5 1/4-inch diskette, double density. File format: Executable code only. The diskettes are in the ASCII format. Price includes documentation, PB–90-213893.

An improved Jet-Plume model has been interfaced with DEGADIS to provide for prediction of the trajectory and dilution of elevated dense gas jets to ground contact. DEGADIS predicts the ensuing ground-level plume dispersion. The Jet-Plume model provides for: automatic adjustment of integration step-size (using the Runge-Kutta-Gill method as in DEGADIS): elliptical plume shape (cross-section), with the Pasquill-Gifford plume dispersion coefficient representation of atmospheric turbulent entrainment; user specification of averaging time; ground reflection when the plume (lower) boundary reaches ground level; and application to scenarios where the plume remains aloft. The model should be uploaded via modem from a PC terminal to host a VAX computer, and several files must then be renamed prior to compilation and execution. The program is written in FORTRAN for compilation and execution on a DEC VAX Computer.

45318 (PB–90-502410/XAB) **Fugitive Dust Model (FDM) (for microcomputers). Model-Simulation.** Carey, P. Environmental Protection Agency, Seattle, WA (USA). May 1990. vp. Source: NTISCP D01.

Computer: IBM/PC compatible. DOS operating system, 500K. Language: FORTRAN. The model may be adapted for operation on a mainframe or other computer system. The model requirements for PC operation are a minimum of 500K of memory and a math coprocessor-chip (e.g. 80287, etc.). An additional requirement is that the device driver, ANSI.SYS or a compatible be installed on the machine. The software is contained on one 1.2M, 5 1/4-inch diskette, high density. File format: Multiple formats. Price includes documentation, PB–90-215203.

The Fugitive Dust Model (FDM) is a computerized air quality model specifically designed for computing concentration and deposition impacts from fugitive dust sources. The sources may be point, line or area sources. The model has not been designed to compute the impacts of buoyant point sources, thus it contains no plume-rise algorithm. The model is generally based on the well-known Gaussian Plume formulation for computing concentrations, but the model has been specifically adapted to incorporate an improved gradient-transfer deposition algorithm. Emissions for each source are apportioned by the user into a series of particle size classes. A gravitational setting velocity and a deposition velocity are calculated by FDM for each class. Concentration and deposition are computed at all user selectable receptor locations...Software Description: The model is written in the Fortran programming language for implementation on an IBM PC compatible using the DOS operating system.

45319 (PB–90-873720/XAB) **Radioactive pollution: Air pollution (excluding radon pollution). January 1975-May 1987 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-May 1987.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 118p. Source: NTISPC N01/MF N01.

See also PB–90-873738.

This bibliography contains citations concerning the contamination of air by radioisotopes emitted from nuclear power plants, radioactive waste burial sites, mines, and nuclear weapons testing. Measurements of radioactive particles in the air in a number of locations worldwide are included. Absorption of radioisotopes from the air to the food chain is examined. Models and computer programs estimating the release of radioactive particles to the atmosphere in the event of a nuclear power plant accident, and measurements of radioactive atmospheric pollution from the Chernobyl accident are emphasized in recent citations. Monitoring instrumentation is briefly described. Radon pollution is covered in other bibliographies. (This updated bibliography contains 240 citations, none of which are new entries to the previous edition.)

45320 (PB–90-873738/XAB) **Radioactive pollution: Air pollution (excluding radon pollution). June 1987-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for June 1987-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 201p. Source: NTISPC N01/MF N01.

Supersedes PB–87-859492. See also PB–90-873720.

This bibliography contains citations concerning the contamination of air by radioisotopes emitted from nuclear power plants, radioactive waste burial sites, mines, and nuclear weapons testing. Measurements of radioactive particles in the air in a number of locations worldwide are included. Absorption of radioisotopes from the air to the food chain is examined. Models and computer programs estimating the release of radioactive particles to the atmosphere in the event of a nuclear power plant accident, and measurements of radioactive atmospheric pollution from the Chernobyl accident are emphasized in recent citations. Monitoring instrumentation is briefly described. Radon pollution is covered in other bibliographies. (This updated bibliography contains 360 citations, all of which are new entries to the previous edition.)

45321 (PNL–6450-33-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report.** Finch, S.M. (comp.). Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 46p.

Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90015837. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This monthly report summarizes the technical progress and project status for the Hanford Environmental Dose Reconstruction (HEDR) Project being conducted at the Pacific Northwest Laboratory (PNL) under the direction of a Technical Steering Panel (TSP). The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that populations could have received from nuclear operations at Hanford since 1944. The project is divided into the following technical tasks. These tasks correspond to the path radionuclides followed, from release to impact on humans (dose estimates): Source Terms, Environmental Transport, Environmental Monitoring Data, Demographics, Agriculture, Food Habits, and Environmental Pathways and Dose Estimates. 3 figs.

45322 (PNL-SA–17954) **The effect of ambient winds on valley drainage winds.** Doran, J.C. Pacific Northwest Lab., Richland, WA (USA). Feb 1990. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9006111–5: Conference on mesoscale processes and mountain meteorology, Boulder, CO (USA), 25-29 Jun 1990). Order Number DE90016341. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

While it is often convenient to assume that the properties of katabatic winds in a deep mountain valley can be described independently of the winds above the ridgetops, such an assumption is clearly invalid in the presence of winds that are strong enough to significantly affect the inversions that may be present in the valley. This paper describes the results of a series of numerical experiments in which the ambient winds outside a valley were varied in both speed and direction. The resultant behavior of the valley drainage winds are shown, comparisons are made with observations, and a discussion of the results is given. 16 refs., 7 figs.

45323 (PNL-SA–18293) **Uncertainties in energy scenarios and their consequences for CO_2 emissions.** Edmonds, J. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9007156–1: Annual meeting of international union of pure and applied chemistry, Petten (Netherlands), 4-6 Jul 1990). Order Number DE90016293. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The current interest in the "greenhouse" issue stems from the observation that the concentrations of such gases as CO_2, Ch_4, N_2O, $CFCl_3$, and CF_2Cl_2 have been increasing. Changes in the concentrations of these gases hold the potential for changing the Earth's climate. This paper will focus on uncertainties in the forecast of net emissions of CO_2 to the atmosphere by human activities. Furthermore, only the net emission of CO_2 from human activities is addressed. The vastly greater annual fluxes of carbon pertaining to the natural carbon cycle are the focus of other papers in this collection, as is the interaction between net emissions of CO_2 to the atmosphere and the atmospheric concentration of CO_2. The importance of human activities as a potential disturbance to the natural carbon cycle, coupled with the importance of CO_2 as a potential disturbance to the Earth's radiation budget, argues for the special attention given here. In general the uncertainty associated with the future emissions of CO_2 to the atmosphere stem from two sources: the source of net emissions and the future course of human activities associated with those emissions. That uncertainty could be reduced by measures taken directly to reduce net emissions. We will discuss each of these topics in turn. 9 refs.

45324 (RFP-ADD–0001) **Analysis of offsite emergency planning zones (EPZs) for the Rocky Flats Plant: Overview.** Hodgin, C.R.; Armstrong, C.; Daugherty, N.M.; Foppe, T.L.; Petrocchi, A.J.; Southward, B. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. 16 May 1990. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE90016099. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Project Plan Overview summarizes the design of a project to complete analysis of offsite Emergency Planning Zones (EPZs) for the Rocky Flats Plant. Federal, state, and local governments develop emergency plans for facilities that may affect the public in the event of an accidental release of nuclear or hazardous materials. One of the purposes of these plans is to identify EPZs where actions could be necessary to protect public health. Public protective actions include sheltering, evacuation, and relocation. Agencies use EPZs to develop response plans and to determine needed resources. DOE and EG&G Rocky Flats, Inc., will develop recommended offsite EPZs for the Rocky Flats Plant (RFP). We will develop recommended sheltering and evacuation EPZs for accidental release of radionuclides to the atmosphere from the facility. We will also develop recommended EPZs for accidental releases of major nonradiological hazardous substances to the atmosphere, and will analyze the impacts of an unplanned surface water release from the facility. DOE and EG&G Rocky Flats will submit these recommendations to the CDH for potential use in the State's offsite emergency planning for the Rocky Flats Plant. 3 refs., 3 figs., 4 tabs.

45325 (SCPRI-RM–11-1989) **Monthly results of measurements, November 1989.** Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France). 1989. 47p. (In French). Order Number DE90514567. Source: NTIS (US Sales Only), PC A03/MF A01.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

45326 (UCRL-CR–103416) **Preliminary evaluation of potential substitutes for chlorofluorocarbon refrigerants at Lawrence Livermore National Laboratory.** Rogozen, M.B. (MBR Environmental Corp., Culver City, CA (USA)). Lawrence Livermore National Lab., CA (USA); MBR Environmental Corp., Culver City, CA (USA). 30 Dec 1989. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015611. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Chlorofluorocarbons (CFCs) are organic compounds composed of carbon, chlorine and fluorine. CFCs are widely used as refrigerants, solvents, and blowing agents, and, although they are chemically inert in the lower atmosphere, CFCs break apart upon reaching the stratosphere and release chlorine, which destroys ozone molecules that serve as the earth's natural barrier to harmful ultraviolet radiation. Growing concern about the damage to stratospheric ozone has led to an international treaty to limit production and use of certain chlorofluorocarbons. Since the use of CFCs is so extensive, major efforts are under way to identify, test, and commercialize CFC substitutes. The objectives of the preliminary investigation reported here were to identify likely substitutes for CFCs used a refrigerants at Lawrence Livermore National Laboratory (LLNL), and to evaluate current information on their feasibility and health effects. Section 2 contains a brief discussion of the regulatory background. Section 3 describes the chlorofluorocarbon refrigerants currently used at LLNL. Substitutes are identified and discussed in Section 4. Section 5 contains recommendations for further research, and references are presented in Section 6. 29 refs., 3 figs., 3 tabs.

45327 (UCRL-CR–104490) **Tropospheric nitrogen: The influence of anthropogenic sources on distributions and deposition: Final report.** Penner, J.E.; Atherton, C.S.; Walton, J.J. Lawrence Livermore National Lab., CA (USA). Apr 1990. 71p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Interagency Agreement DW89932676-01-0. Order Number DE90015408. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

We present a three-dimensional modeling study of the global cycle of reactive nitrogen in the troposphere. We include all of the known major sources of NO_x: lightning, soil microbial activity, oxidation of N_2O in the stratosphere and its transport to the troposphere, fossil-fuel combustion, and biomass burning. We present calculations for the gas-phase concentrations NO_x and HNO_3 throughout the troposphere, as well as for the deposition of nitrate in precipitation and by dry deposition. 132 refs., 35 figs., 7 tabs.

45328 The initial behavior of ^{218}Po in indoor air. Hopke, P.K. (Univ. of Illinois, Urbana-Champaign (USA)). *Environment International (USA),* 15(1-6): 299-308 (1989). DOE Contract FG02-87ER60546.

The chemical and physical properties of ^{218}Po, immediately following its formation from ^{222}Rn decay, are important in determining its behavior in indoor atmospheres and play a major part in determining its potential health effects. In 88% of the decays, a singly charged, positive ion of ^{218}Po is obtained at the end of its recoil path. The modes of neutralization, small ion recombination, electron transfer, and electron scavenging are reviewed. In typical indoor air, the ion will be rapidly neutralized. The neutral molecule can then become incorporated in ultrafine particles formed by the radiolytic processes in the recoil path. The evidence for these particles is presented.

45329 The genotoxic contribution of wood smoke to indoor respirable suspended particles. Boone, P.M. (John B. Pierce Foundation Laboratory, New Haven, CT (USA)); Rossman, T.G.; Daisey, J.M. *Environment International (USA),* 15(1-6): 361-368 (1989).

The effect of wood burning stoves on the genotoxicity of indoor respirable organic matter was investigated for four homes during the winter and spring of 1986. Paired samples, one collected when the stove was not used and one when wood was burned, were extracted with dichloromethane and acetone. Aliquots of the dichloromethane extracts were analyzed with and without metabolic activation using the Microscreen bioassay. The Microscreen is a rapid, sensitive bioassay which measures a broad genotoxic endpoint, λ-prophage induction. Per nanogram of organic material, wood smoke proved to be a major source of indirect (observed with metabolic activation) but not direct genotoxins in homes. The increase in indirect genotoxicity for extracts from aerosol containing wood smoke is probably due to higher concentrations of polycyclic aromatic hydrocarbons in the wood smoke aerosol as well as other unidentified classes. The direct genotoxicity observed for extracts of aerosol not containing wood smoke decreased with metabolic activation. This direct genotoxicity may be related to cooking activities in the homes. The trends in genotoxicity observed per nanogram of organic material are more pronounced when expressed per m^3 of air due to the higher percentage of extractable material in aerosol containing wood smoke.

45330 Comparison of the organic chemical composition of indoor aerosols during woodburning and non-woodburning periods. Daisey, J.M. (Lawrence Berkeley Laboratory, CA (USA)); Spengler, J.D.; Kaarakka, P. *Environment International (USA),* 15(1-6): 435-442 (1989). DOE Contract AC03-76SF00098.

Concentrations of respirable particulate matter (RSP), extractable organic matter (EOM) and polycyclic aromatic hydrocarbons (PAH) were compared in seven Wisconsin homes during woodburning and non-woodburning periods. No statistically significant difference was observed between the two periods for RSP concentrations. Concentrations of EOM, however, were approximately two times higher and concentrations of PAH were 2 to 46 times higher during the periods when the wood stoves were in operation. The average source strength for emissions or particulate organic matter for the airtight stoves in five of the homes was estimated to be 1.8 mg - h^{-1}.

45331 Indoor air quality investigations: A practitioner's approach. Gammage, R.B. (Oak Ridge National Laboratory, TN (USA)); Hansen, D.L.; Johnson, L.W. *Environment International (USA),* 15(1-6): 503-510 (1989). DOE Contract AC05-84OR21400.

A practical strategy is outlined for investigating office environments in which the occupants are complaining about the indoor air quality and where traditional industrial hygiene TLVs cannot cope. In such situations, the available budget, time for conducting an investigation, and the monitoring resources are often quite limited. Attention focuses on ventilation, microorganisms, and volatile organic compounds (VOC). Ensuring proper functioning of the air handling unit is essential. Simple procedures are given for determining ventilation needs by measuring CO_2 concentrations. Complaints should be minimal if the fresh air supply is at least 10 L/S per occupant and the CO_2 concentration remains below 1000 μL/L. Coarse screening measurements are advocated for microorganisms and total VOC. Their purpose is to help define the general environmental conditions. If levels of nonspecific microorganisms exceed 500 colony forming units per m^3, then improvements in general housekeeping and sanitary conditions are advised. If the levels of total nonspecific VOC exceed 1 μL/L, then the VOC could be implicated in occupant dissatisfaction with air quality. Further action might include more definitive organic measurements, trying to locate and perhaps remove the strongest VOC sources, or increasing ventilation to dilute the VOC. If the screening measurements yield less than 500 CFU per m^3 and 1 μL/L for microorganisms and VOC, respectively, then further, more definitive, measurements will probable not be particularly useful.

45332 Air velocities inside domestic environments: An important parameter in the study of indoor air quality and climate. Matthews, T.G. (Oak Ridge National Laboratory, TN (USA)); Thompson, C.V.; Wilson, D.L.; Hawthorne, A.R.; Mage, D.T. *Environment International (USA),* 15(1-6): 545-550 (1989). DOE Contract AC05-84OR21400.

Very low air velocities were measured in six occupied homes and one unoccupied house particularly when forced-air air-conditioning systems (i.e., HVAC) were turned off. Segregating the velocity data by monitoring site, median velocities of 4.2, 4.3, 10.2, and 12.4 cm/s were found in the master bedroom, basement, and kitchen of the six occupied homes and the dining/living room of the unoccupied house, respectively. In the occupied homes, the comparatively high velocities in the kitchens correlated with increased occupant activities and the use of ceiling and/or exhaust fans. Segregating the data by use of forced-air HVAC systems, the median velocities increased from 5.8 to 6.2, 3.2 to 5.7, 1.5 to 8.1, and 4.4 to 15.5 cm/s with HVAC operation in three occupied houses and one unoccupied house, respectively. The lowest median velocity of 1.1 cm/s was found in a parent's bedroom, where occupant activities were purposely limited and the HVAC was off. These low air velocities raise concern that air movement may sometimes be inadequate for quantitative passive monitoring of pollutant vapors. Ten and 50% reductions in sampling rates are reported in the literature for passive monitors at air velocities ranging from <0.7 to 25 cm/s and from <0.7 to 2 cm/s, respectively. In addition, low velocities may limit off-gassing from evaporatively controlled emitters and decrease the thermal comfort of inhabitants under warm and humid conditions.

45333 A wind tunnel study to design large, open-top chambers for whole-tree pollutant exposure experiments. Baldocchi, D.D. (National Oceanic and Atmospheric Administration's Air Resources Lab., Oak Ridge, TN (USA)); White, R.; Johnston, J.W. *Journal of the Air and Waste Management Association (USA),* 39(12): 1549-1556 (Dec 1989). DOE Contract AC05-84OR21400.

A wind tunnel study was conducted to determine the optimal design features of a large, open-top chamber, as needed for pollution exposure studies on mature trees. An optimally-designed, open-top chamber must minimize the incursion of ambient air through its opening and maintain a uniform treatment concentration throughout the chamber. The design features of interest are the diameter and height of the chamber and the deflection angle and opening size of any frustum that may be mounted on top of a model chamber. The main design features of open-top chambers are the velocity of air exiting through the top and the relationship between the length scale of the turbulence and the diameter of the chamber opening. As exit velocities increase, the proportion of eddies with sufficient force to penetrate into the chamber decrease. Therefore, for equal volumetric air flows, smaller opening sizes increase the exit velocities and reduce the number and extent of ambient air incursions. Almost total exclusion of ambient air is achieved as the exit velocity of the air exceeds the magnitude of one standard deviation of the vertical wind velocity measured at the chamber top. The incursion of ambient air is also reduced when the diameter of the chamber opening is smaller than the characteristic length scale of the turbulence, a measure of mean eddy size.

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Refer also to citation(s) 43708, 43709, 43711, 43712, 43715, 43752, 43843, 43844, 43904, 43924, 43952, 43959, 43962, 43966, 44004, 44008, 44010, 44370, 44395, 44416, 44558, 44570, 44576, 45154, 45228, 45247, 45257, 45321, 45325, 45462, 45467, 45468, 45475, 45481, 45482, 45484, 45485, 45487, 45491, 45499, 45500, 45501, 45504, 45505, 45507, 45515, 45591, 45596

45334 (AD-A-221186/0/XAB) **In-situ soil decontamination by radio-frequency heating-field test. Final report, January 1987-April 1988.** Dev, H.; Enk, J.; Stresty, G.; Bridges, J.; Downey, D. IIT Research Inst., Chicago, IL (USA). Sep 1989. 190p. Source: NTIS, PC A09/MF A01.

This report summarizes a successful pilot test of radiofrequency soil decontamination performed at an abandoned fire training area on Volk Field ANGB WI. The results of preliminary laboratory column studies are provided as well as complete discussion of soil sampling and analytical methods. Approximately 500 cubic feet of soil was heated to a temperature of 150 C using radiofrequency energy. During the 12 days of heating, the hot vapors were collected from the soil surface and concentrated using a condenser and activated carbon. Final soil sampling showed excellent removal rates of fuel contaminants. Over 99 percent of the aromatic compounds, such as benzene, were removed from the soils. Less volatile aliphatics were reduced by over 95 percent. Provides a complete summary of operating conditions and soil decontamination results.

45335 (DOE/ER/60932–1) **Grassland/atmosphere response to changing climate: Coupling regional and local scales: Annual progress report.** Coughenour, M.B. (Colorado State Univ., Fort Collins, CO (USA). Natural Resources Ecology Lab.); Kittel, T.; Parton, W.; Pielke, R.A. Colorado State Univ., Fort Collins, CO (USA). 28 Jul 1990. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER60932. Order Number DE90015814. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study is an interdisciplinary research project designed to increase our understanding of the ecological impacts of climate change and elevated CO_2 projected to occur over the next 50 to 100 years due to globally increasing atmospheric levels of CO_2 and other greenhouse gases. The project study area is the North American Central Grasslands. The objectives are to develop multi-scaled modeling systems linking extant state-of-the-art models from the ecological and atmospheric sciences with different spatial and temporal resolutions and to evaluate the response of grassland ecosystems to atmospheric change at regional and site scales. Responses are to be evaluated in terms of ecosystem function and potential biospheric impacts to climate. In the first seven months of the first year, we have implemented fine-scaled models of photosynthesis and decomposition, used regional and site level ecosystem models, in an unlinked mode, to simulate ecosystem response to climate and CO_2 change, addressed scaling issues associated with linking models. Time remains in this first budget period to complete other tasks. Second year work is discussed and does not significantly vary from that described in the original proposal. 27 refs., 4 figs.

45336 (LA–11794-MS) **Plutonium deposition and distribution from worldwide fallout in northern New Mexico and southern Colorado.** Purtymun, W.D.; Peters, R.J.; Maes, M.N. Los Alamos National Lab., NM (USA). Aug 1990. 13p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. Order Number DE90014818. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Samples of soil, river, and reservoir sediment were collected and analyzed for two isotopes of plutonium from 1979 through 1987. The plutonium is principally a manmade element, but it has been distributed throughout the world as a result of fallout from nuclear weapons tests and from reentry of satellites that contained a nuclear power source. Fallout is deposited on soil and is subject to erosion and transport as sediment in rivers and deposition in reservoirs. The soil samples collected from northern New Mexico and southern Colorado indicated slight, but significant, differences in the concentrations and ratios of $^{239,240}Pu$ to ^{238}Pu in soil, river, and reservoir sediments. The differences in plutonium concentrations and ratios found in the environment can be attributed to regional and local weather patterns and to distribution by physical transport into rivers and reservoirs. The variability in plutonium particle sizes also contributes to the inconstancy of plutonium concentrations and ratios found in soils and sediments. 13 refs., 5 figs., 5 tabs.

45337 (ORNL/RASA–89/3) **Results of the radiological survey of the Carpenter Steel Facility, Reading, Pennsylvania.** Cottrell, W.D.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Jul 1990. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90015834. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In 1944, experimental uranium-forming work was conducted by Carpenter Technology Corporation at the Carpenter Steel Facility in Reading, Pennsylvania, under contract to the Manhattan Engineer District (MED). The fabrication method, aimed at producing sounder uranium metal and improving the yields of rods from billets, was reportedly soon discarded as unsatisfactory. As part of the Department of Energy's (DOE) efforts to verify the closeout status of facilities under contract to agencies preceding DOE during early nuclear energy development, the site was included in the Formerly Utilized Sites Remedial Action Program (FUSRAP). At the request of DOE, the Measurement Applications and Development Group of the Health and Safety Research Division of Oak Ridge National Laboratory performed a radiological assessment survey in July and August 1988. The purpose of the survey was to determine if past operations had deposited radioactive residues in the facility, and whether those residuals were in significant quantities when compared to DOE guidelines. The survey included gamma scanning; direct measurements of alpha activity levels and beta-gamma dose rates; sampling for transferable alpha and beta-gamma residuals on selected surfaces; and sampling of soil, debris and currently used processing materials for radionuclide analysis. All survey results were within DOE FUSRAP guidelines derived to determine the eligibility of a site for remedial action. These guidelines are derived to ensure that unrestricted use of the property will not result in any measurable radiological hazard to the site occupants or the general public. 4 refs., 5 figs., 5 tabs.

45338 (ORNL/RASA–90/4) **Results of radiological surveys of 20 borough-owned properties, Maywood, New Jersey (MJ050).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Aug 1990. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90015785. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of these 20 borough-owned properties Maywood, New Jersey, was conducted during 1987. Survey measurements indicate that none of the properties contained radioactive contamination. Slightly elevated gamma exposure rates in several areas were related to the presence of ashes or to natural materials used in the construction of buildings and asphalt surfaces. 4 refs., 1 figs., 1 tab.

45339 (PB–90-226077/XAB) **Direct/Delayed Response Project: Field operations and quality assurance report for soil sampling in the Mid-Appalachian Region of the United States.** Kern, J.S.; Lee, J.J. Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab. Jun 1990. 213p. (EPA–600/3-90/045). Source: NTIS, PC A10/MF A02.

The Direct/Delayed Response Project (DDRP) has been designed and implemented by the U.S. Environmental Protection Agency to reduce uncertainties in current understanding of the effects of acidic deposition on surface waters chemistry. The response of watersheds to acidic deposition is being assessed for

selected study regions using data from DDRP watershed surveys, USEPA surface water surveys, and acidic deposition data. The document describes the planning activities, field activities, and the quality assurance/quality control (QA/QC) operations associated with soil sampling in the Mid-Appalachian Region of the United States. The watersheds mapped were chosen from those studied by the USEPA National Surface Water Survey. The objective of the soil sampling was to collect samples to characterize the physical and chemical properties of soil from watersheds that were mapped by the DDRP. The activities resulted in 100 percent of the selected pedons being sampled.

45340 (PB–90-227950/XAB) **EPA workshop on radioactivity-contaminated sites. Held in Albuquerque, New Mexico on May 3-5, 1989.** Office of Radiation Programs, Washington, DC (USA). Mar 1990. 181p. (EPA–520/1-90/009). Source: NTIS, PC A09/MF A01.

The report is a compilation of reports presented at a workshop that was sponsored jointly by the Environmental Protection Agency's Office of Radiation Programs and Office of Emergency and Remedial Response. They include status reports from DOE, DOD, and private industry, EPA case studies, and summaries of applicable technology and research.

45341 (PB–90-231655/XAB) **Hillslope erosion at the Maxey Flats radioactive waste disposal site, northeastern Kentucky. Water Resources Investigation.** Carey, W.P.; Lyverse, M.A.; Hupp, C.R. Geological Survey, Louisville, KY (USA). Water Resources Div. 1990. 45p. (USGS-WRI–89-4199). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

Maxey Flats, a disposal site for low-level radioactive waste, is on a plateau that rises 300 to 400 feet above the surrounding valleys in northeastern Kentucky. Hillslope gradients average 30 to 40 percent on three sides of the plateau. The shortest distance from a hillslope to a burial trench is 140 feet on the west side of the site. The report presents the results of a 2-year study of slope erosion processes at the Maxey Flats disposal site, and comments on the long-term integrity of the burial trenches with respect to slope retreat. Thus, the report is of much broader scope in terms of earth-surface processes than the period of data collection would suggest. As such, the discussion and emphasis is placed on infrequent, large-magnitude events that are known to occur over the time scale of interest but have not been specifically documented at the site.

45342 (PB–90-242397/XAB) **Investigation of rate processes in the thermal treatment of contaminated soils. Final report, November 1986-November 1989.** Lighty, J.S.; Silcox, G.D.; Pershing, D.W. Utah Univ., Salt Lake City, UT (USA). Dept. of Chemical Engineering. Mar 1990. 149p. Source: NTIS, PC A07/MF A01.

The objective of the project was to evaluate and define the treatability limits for thermal treatment processes which can be used to remediate soils from manufactured gas plant (MGP) sites and other wastes. Successful application of thermal treatment technologies as well as prediction and optimization of process performance is dependent on a thorough understanding of soil/contaminant interactions, contaminant desorption and transport, and heat and mass transfer within treatment systems. The experimental results given in the final report were used to define the rate limiting step(s) in the desorption of contaminant. Data and modeling of desorption from a particle and a bed of soil are discussed. Temperature appears to be the most important variable in the desorption of contaminant from the soil due to the adsorptive nature of the soil and the contaminant. The resistances of the soil to heat and mass transfer are also important; beds of soil take longer to heat up and the contaminant mass transfer is slower.

45343 (PNL–7348) **Honeybees as monitors of low levels of radioactivity.** Simmons, M.A. (Pacific Northwest Lab., Richland, WA (USA)); Bromenshenk, J.J.; Gudatis, J.L. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 9p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90014823. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Large-scale environmental monitoring programs rely on sampling many media – air, water, food, et cetera – from a large network of sampling stations. For describing the total region possibly impacted by contaminants, the most efficient sampler would be one that covered a large region and simultaneously sampled many different media, such as water, air, soil, and vegetation. Honeybees have been shown to be useful monitors of the environment in this context for detecting both radionuclides and heavy metals. This study sought to determine the effectiveness of honeybees as monitors of low levels of radioactivity in the form of tritium and gamma-emitting radionuclides. For the study, approximately 50 honeybee colonies were placed on the Hanford Site and along the Columbia River in areas downwind of the site. The mini-hive colonies were sampled after 1 month and tested for tritium and for gamma-emitting radionuclides. From this and other studies, it is known that honeybees can be used to detect radionuclides present in the environment. Their mobility and their ability to integrate all exposure pathways could expand and add another level of confidence to the present monitoring program. 6 refs., 1 fig., 2 tabs.

45344 (PNL–7425) **Review of municipal sludge use as a soil amendment on disturbed lands.** Brandt, C.A.; Hendrickson, P.L. Pacific Northwest Lab., Richland, WA (USA). Aug 1990. 26p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. Order Number DE90015835. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy is examining options of improving soil conditions at Hanford reclamation sites. One promising technology is the incorporation of municipal sewage sludge into the soil profile. This report reviews the potential benefits and adverse consequences of sludge use in land reclamation. Land reclamation comprises those activities instigated to return a mechanically disturbed site to some later successional state. Besides the introduction of suitable plant species to disturbed lands, reclamation generally requires measures to enhance long-term soil nutrient content, moisture retention or drainage, and mitigation of toxic effects from metals and pH. One of the more effective means of remediating adverse soil characteristics is the application of complex organic manures such as municipal sewage sludge. Sewage sludges contain complete macro- and micronutrients necessary to sustain plant growth. The application of sewage sludge may reestablish microbial activity in sterile soils. Physical properties, such as water-holding capacity and percentage water-stable aggregates, also improve with the addition of sewage sludge. Sludge applications may also increase the rate of degradation of some hydrocarbon pollutants in soils. Potential adverse impacts associated with the application of sewage sludge to land include negative public perception of human waste products; concerns regarding pathogen buildup and spread in the soils, plants, and water; entrance and accumulation of heavy metals in the food chain; salt accumulation in the soil and ground water; leaching of nitrates into ground water; and accumulation of other potentially toxic substances, such as boron and synthetic hydrocarbons, in the soil, plants, and food chain. 56 refs., 10 tabs.

45345 (PNL-SA–17612) **Organic liquid infiltration into unsaturated porous media.** Simmons, C.S.; McBride, J.F.; Lenhard, R.J.; Cary, J.W. Pacific Northwest Lab., Richland, WA (USA). Apr 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900476–1: IAH conference on subsurface contamination by immiscible fluids, Calgary (Canada), 18-20 Apr 1990). Order Number DE90015288. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Infiltration experiments with immiscible organic liquids (Soltrol [Philips Petroleum Co., Bartlesville, OK.], mineral oil, and transmission oil) were performed in boxes packed uniformly with sand or glass beads to test a multiphase flow model. Porous media was slightly wet to mimic a vadose zone. Resulting three-dimensional oil plumes and water contents were measured from core samples and photographs of vertical cross sections. Soltrol and transmission oil, with a zero and positive spreading coefficient, respectively, gave regularly shaped plumes similar to those predicted by the model. However, mineral oil with a negative spreading coefficient exhibited fingering behavior that was not accurately simulated by the continuum model. The implication is that constitutive theory may not predict well the flow of a nonspreading oil in a vadose zone. 8 figs.

45346 (PNL-SA-17922) **Diffusion coefficients and hydraulic conductivity in unsaturated Hanford soils and sediments.** Wright, J.V. Pacific Northwest Lab., Richland, WA (USA). Jan 1990. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900406-75: 1. international topical meeting on high-level radioactive waste management, Las Vegas, NV (USA), 8-12 Apr 1990). Order Number DE90015973. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Two groundwater transport parameters of some Hanford formation materials, the hydraulic conductivity and the diffusion coefficient, were measured to aid in predicting contaminant migration. The hydraulic conductivities and diffusion coefficients for five soil types were determined as functions of the water content for the aqueous phase. The degree of saturation in the soil was fixed at desired levels by use of a high-speed core ultracentrifuge with an ultralow constant-rate flow pump feeding water into the sample through a rotating seal. Diffusion coefficient values were calculated from the measured electrical conductivity values using the Nernst-Einstein equation. 13 refs., 4 figs., 1 tab.

45347 (PSI-60) **Hydrogeological characterisation of the migration experimental area at the Grimsel test site.** Hoehn, E. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Fierz, Th.; Thorne, P. Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland). Jun 1990. 60p. Order Number DE90636670. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Tracer migration experiments in a single fracture in granodiorit rock are in progress at the underground Grimsel Test Site (GTS), to test radionuclide transport models. This report recapitulates the exploration of the site and provides information on the location. Preliminary estimations of groundwater flow velocities into the tunnel in four different fracture zones led to a selection of a location considered optimally suited for migration experiments. The hydrogeology of the chosen single (proto)mylonic fracture was unknown at the scale of about 10x10 m and had to be explored with boreholes. Ten boreholes proved that the fracture is an almost planar element in the water-saturated rock mass. Eight boreholes yield sufficient groundwater for the measurement of hydraulic pressure and for groundwater sampling. Most boreholes are equipped with a system of triple packers which isolate the fracture and the borehole mouth. Passive hydraulic tests proved that a hydraulic connection exists between the boreholes and that the transmissivity of the fracture is about 0.6 m^2/d. Long-term monitoring revealed a decline of hydraulic pressure of about 0.08 bar/y, which indicates that the hydraulic system, has not yet fully reached a steady state. Plastic sheets mounted on the wall of the tunnel at its intersection with the fracture allow the measurement of the discharge of groundwater, which is in the order of 0.5 L/min at the migration location. From the observation of breakthrough phenomena during drilling of boreholes and the miscible displacement of groundwaters of slightly different composition during injection-extraction experiments, a flow velocity at the migration location was estimated to be in the order of a few meters per hour. The groundwater does not contain tritium in detectable amounts and, therefore, the reservoir volume of groundwater, which discharges to the tunnel, must be high.

45348 (SKB-TR-90-01) **FARF31 - a far field radionuclide migration code for use with the PROPER package.** Norman, Sven (Starprog AB, Stockholm (Sweden)); Kjellbert, Nils. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1990. 60p. Order Number DE90636638. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The far field radionuclide migration computer code FARF31 has been developed as a submodel to the probabilistic package PROPER, and can be considered a refined and less CPU-time consuming version of the far field models used in the KBS-3 study. FARF31 constitutes the numerical equivalent of a dual porosity model for radionuclide migration along a stream tube in fractured rock. It calculates the migration rate of the radionuclide chains at the exit of the tube given the input rates at the entrance. Advection, dispersion and one dimensional matrix diffusion is taken into account as well as chain decay. The underlying equations are formulated in terms of groundwater travel time and Peclet number, thus allowing for the groundwater travel time to be computed outside FARF31 by a separate submodel fitted to handle Darcy velocities and kinematic porosities which vary in space. Input migration rate boundary conditions are arbitrary. (authors).

45349 (UCRL-CR-104084) **Biological impacts associated with the proposed retention basin and ground water projects at Lawrence Livermore National Laboratory (LLNL), and the ground water projects at Site 300.** Lawrence Livermore National Lab., CA (USA); BioSystems Analysis, Inc., Tiburon, CA (USA). 30 May 1990. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015609. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document discusses impacts for the proposed retention basin and ground water projects at Lawrence Livermore Laboratory. Topics discussed include positive impacts, negative impacts, mitigation and monitoring. 4 refs. (KJD)

45350 (UM-P-89/64) **Study of melt produced bodies observed at Henbury crater region.** Hopper, V.D. (Melbourne Univ., Parkville (Australia). School of Physics); Sewell, D.K.B.; Aitken, D.K. Melbourne Univ., Parkville (Australia). School of Physics. [1989]. 21p. Order Number DE90636650. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Spherical and non spherical bodies derived from target rock and meteorite components have been found in samples of soil in the Henbury crater region. From a study of the composition of these bodies, the compositions of the meteorite and the target rock, it has been possible to separate the bodies into three groups showing differing degrees of volatilization of various oxides. The composition of a number of the soil samples were measured using X-ray fluorescence. A selected number were then examined by a scanning electron microscope fitted with an energy dispersive X-ray analyzer. Where Ni was definitely identified, it was examined by an electron microprobe X-ray analyzer. A major finding was the depletion of SiO_2 in the production of both Group 1 and Group 3 bodies. Group 3 bodies are not volatilized to the same extent as Group 1. With no reference to the target rock , the general order of volatility appears to be $Na_2O > MgO > K_2O > TiO_2$, SiO_2 and Al_2O_3, the significant change being the place of SiO2. 13 refs., 7 figs., 5 tabs.

45351 (WHC-EP-0332) **Simulations of infiltration of meteoric water and contaminant plume movement in the vadose zone at single-shell tank 241-T-106 at the Hanford Site.** Smoot, J.L. (Pacific Northwest Lab., Richland, WA (USA)); Szecsody, J.E.; Sagar, B.; Gee, G.W.; Kincaid, C.T. Westinghouse Hanford Co., Richland, WA (USA). Nov 1989. 121p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE90015819. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Contaminant plume migration in the vadose zone from a leak at Tank 241-T-106 on the Hanford Site was modeled to determine the effect of coarse backfill covers on the infiltration of meteoric water and the subsequent transport of contaminants. Infiltration through the upper 2 m of soil cover was simulated for the period of 1947 to 2020 using hydraulic properties estimated for the backfill sediments. The Tank 241-T-106 leak was simulated for the period 1960 to 1990 using an infiltration average of 77 percent of precipitation. The results of the simulations indicate that increased meteoric water infiltration because of the presence of coarse surface sediments increases the rate of movement of ^{106}Ru. The simulations show the ^{106}Ru plume approaching the water table in the early 1980's, but subsequent radioactive decay appears to preclude the plume from moving into the saturated zone. The simulated ^{137}Cs plume migrates considerably less distance than the ^{106}Ru plume because of greater sorption. The increased plume mobility compared to previous simulations at lower infiltration rates implies that remedial action, in the form of an infiltration barrier, could be an effective means to inhibit the movement of the plume. 22 refs., 19 figs., 7 tabs.

45352 Utilization of vertical and horizontal dipole configurations of the EM 34-3 for contaminant mapping in faulted terrain. Morgenstern, K.A. (Ecology and Environment, Inc., Seattle, WA (USA)); Syverson, T.L. pp. 84-92 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference

and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Ecology and Environment, Inc. (E&E) performed an electromagnetic (EM) conductivity survey, using the Geonics Ltd. EM 34-3 and EM-31, at a specialty metals manufacturing facility in southeastern Idaho to identify potential groundwater contaminant plumes migrating from two waste disposal ponds located at the site. Exploration depths from 6 m. to 60 m. below ground surface (bgs) were investigated to characterize subsurface conditions at the site. Large areas were surveyed down gradient of two waste ponds, and an up gradient grid was used to establish background terrain conductivity levels of local subsurface materials. The survey results indicate contaminant migration within the basalt aquifer and illustrated the differences in sensitivity between the vertical and horizontal dipole configurations of the EM 34-3. The study results indicated two anomalies, interpreted to be contaminant plumes, located adjacent to and down gradient of the waste ponds. One plume was detected equally by both the vertical and horizontal dipole configurations. The second plume was detected only with the vertical dipole configuration. Based on the data from the two dipoles, the first anomaly is interpreted to represent contaminant migration along an interflow zone between depths of approximately 15 and 30 m. bgs. In contrast, the second anomaly is interpreted to represent contaminant migration concentrated along two near-vertical intersecting faults near the southwest corner of the site. The data showed that the EM 34-3 responded differently to each of the two plumes, and indicate that the use of both the vertical and horizontal dipole configurations, at overlapping exploration depths, increases the sensitivity of the instrument in mapping subsurface features. 11 refs., 12 figs., 2 tabs.

45353 Expert system utilization for environmental compliance monitoring. Lockerd, M.J. (Booz, Allen and Hamilton Inc., Colorado Springs, CO (USA)). pp. 93-96 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The overwhelming complexity and dynamic nature of environmental compliance regulations presents a major challenge to environmental managers. Most managers do not have time to read and understand the regulations, determine how those regulations apply to their facilities, and then, transfer this knowledge to other managers and environmental auditors. One area holding great promise for a solution to this challenge is expert systems. This paper describes how an expert system can improve environmental compliance monitoring programs. It is based upon work done for the USAF ECAMP and demonstrates that expert systems can: be a primary environmental auditing tool or be used as a program QA or teaching tool; improve environmental audit completeness and accuracy; increase auditor productivity; substantially improve report generation versatility; track non-compliance events. As the US EPA has shown an increasing interest in expert systems for this application, this discussion will serve as a basis of current understanding on the subject. 3 refs., 2 figs.

45354 Applications of x-ray fluorescence spectroscopy for site screening. Sackman, A.R. (Ecology and Environment, Inc., Denver, CO (USA)); Perlis, R.; Chapin, M. pp. 97-102 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Recent field investigations have demonstrated the successful use of X-ray fluorescence spectroscopy (XRF) screening analysis for metal contamination at various hazardous waste sites. Using minimal sample preparation and field sampling methods, the results were comparable to laboratory results using conventional methods such as atomic absorption (AA) and inductively coupled plasma (ICP). Multi-elemental analysis was performed on soil samples with particular interest in lead, arsenic, chromium, copper, and zinc levels. Detection limits achieved for some elements were 10 ppm. The XRF results were used in mapping and contouring the extent of contamination of a hazardous waste site containing inorganic contamination. The lower detection limits and quick turn-around times proved the feasibility of using the XRF in screening hazardous waste sites and environmental monitoring. 5 refs., 5 figs., 4 tabs.

45355 In-situ vitrification processing of soils contaminated with hazardous wastes. Timmerman, C.L. (Pacific Northwest Lab., Richland, WA (USA)); Buelt, J.L.; Fitzpatrick, V.F. pp. 137-156 of Petroleum contaminated soils: Volume 1. Kostecki, P.T.; Calabrese, E.J. Lewis Publishers, Chelsea, MI (USA) (1989). (CONF-8709366--: 2. national conference on environmental and public health effects of soils contaminated with petroleum products, Amherst, MA (USA), 28-30 Sep 1987).

This paper describes the large-scale ISV system, discusses its capabilities, and summarizes the results of testing to date. The authors suggest that ISV offers technical and economic improvements to state-of-the-art remedial action technology and that with an understanding of the process design and functions, the waste manager can make sound judgments about the applicability of ISV to site-specific disposal problems.

45356 Degradation and advection of 1,1,1-trichloroethane in the saturated zone containing residual solvent. Cline, P.V. (CH2M Hill, Gainesville, FL (USA)); Delfino, J.J.; Potter, T. pp. 108-112 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Following a spill of 1,1,1-trichloroethane (TCA) or a dense solvent mixture containing TCA, the porous media may contain from 5 to 50 l./m.3 of an immiscible residual solvent phase in the saturated zone. Two of the natural pathways for the removal of the residual TCA include: (1) chemical degradation, and (2) dissolution and advection from this zone via groundwater flow. Chemical degradation of TCA produces 1,1 -DCE and acetic acid. The zero-order degradation rate in the zone containing residual solvent is a function of the aqueous phase concentration and the first-order degradation rate. The aqueous solubility also determines the amount of solvent removed through advection. The aqueous concentration is a function of the solubility of TCA and the mole fraction of TCA in the solvent phase. A simplified model illustrates concentration changes of TCA and 1,1-DCE in the residual zone as a function of groundwater flow rate and the presence of other non-reactive components in the solvent phase. 10 refs., 10 figs., 1 tab.

45357 Case study of factors favoring natural attenuation as the preferred alternative for aquifer restoration. Hebert, R.L. (E.C. Jordan, Portland, ME (USA)); Sczurko, J.J.; Lewis, R.A. pp. 113-118 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This paper focuses on a Superfund site where natural attenuation was selected as the preferred remedial alternative for aquifer restoration. The site conditions and relevant factors that favored this selection are described. The groundwater contaminant concentrations were not largely toxic, and the contaminant distribution was limited. The site hydrogeology was characterized by a slight upward hydraulic gradient, and groundwater discharged into a nearby wetland area and drainage canal which represented a natural compliance point. Transport modeling and environmental fate considerations indicated that contaminant concentrations likely would not exceed Maximum Contaminant Levels (MCLs) at the compliance point, and MCLs would probably be achieved everywhere on-site within 15 to 20 yr. Groundwater at the site is not used as a drinking water source at present, and land use projections indicate that it is unlikely to be used as one in the future. Additional relevant topics discussed in this paper include: (1) source control remedial actions to be implemented that are based on protection of groundwater quality; (2) design considerations for the long term monitoring system to demonstrate the effectiveness of natural attenuation; and (3) cost comparisons between the natural attenuation and active restoration remedial alterative that were analyzed in the Feasibility Study (FS). 9 refs., 2 figs., 2 tabs.

45358 Use of U.S. EPA's EXAMS model to predict fate of contaminants into the Rhine and Monongahela Rivers. Tope, T.J. (Vanderbilt Univ., Nashville, TN (USA)); Travis, D.S.; Parker,

F.L. pp. 119-124 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Mathematical models are frequently used to simulate environmental events and predict the impact of those events on the environment. A major shortcoming in the use of these models is the lack of verification of their accuracy. Two significant releases of hazardous chemicals to large river systems within the last 2 yr provide a rare opportunity to compare actual measured concentrations from those spills with predicted concentrations generated by the widely used U.S. EPA's Exposure Analysis Modeling System (EXAMS). The EXAMS modeling system was designed for rapid evaluation of the behavior of synthetic organic chemicals in aquatic ecosystems. EXAMS simulates three chemical release characteristics: exposure, fate, and persistence. The two hazardous chemical releases evaluated in this paper are the Nov. 1, 1986 spill of insecticides, herbicides, and fungicides into the Rhine River and the Jan. 2, 1988 spill of diesel fuel into the Monongahela River. The purpose of this paper is to compare measured contaminant concentrations from these events to values generated by the EXAMS model. The ability of the EXAMS model to predict the chemical contaminants' fate, persistence, and exposure in the ecosystems is discussed. Finally possible sources of discrepancies between predicted and measured values are offered. 9 refs., 3 figs., 6 tabs.

45359 Applications of solute transport modeling for evaluation of remediation alternatives and setting of groundwater clean-up levels. Ozbilgin, M.M. (James M. Montgomery, Consulting Engineers, Inc., Lake Worth, FL (USA)); Bond, L.D.; Gleason, P.J.; Kavanaugh, M.C.; Bartel, T. pp. 125-131 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A modified finite difference solute transport model developed by the United States Geological Survey (USGS) was used to optimize a groundwater remediation system and to develop alternative cleanup levels at a Florida site of soil and groundwater contamination. This Site contains an electronics manufacturing and fabrication facility built in 1973. In 1982, facility operators discovered that a former concrete tank used to hold degreasing solvents prior to disposal had been destroyed and buried on-site. Subsequent investigations of the soil and groundwater determined that an unknown amount of degreasing solvents, predominantly 1,1,1-trichloroethane (TCA), apparently had leaked from the tank and had contaminated the soil and the groundwater. Site investigations conducted by consulting engineers in 1986 confirmed that groundwater contamination had occurred and determined the horizontal and vertical extent and the nature of the solvent contamination. Twelve volatile organic chemicals (VOCs) were detected in the groundwater at concentrations as high as 100 mg/1. The dominant VOCs are TCA, 1,1-dichloroethane (DCA) and 1,1-dichloroethane (DCE), with an estimated 50 million gal of groundwater contaminated with VOCs at levels above Florida Department of Regulations (FDER) drinking water standards (7 μg/1 for DCE, 200 μg/1 for TCA). The contamination extends to a depth of 1 4-0 ft. Contamination of the soil with VOCs, on the other hand, was minimal indicating that the bulk of the spill had already reached the groundwater, which is only 4 to 6 ft beneath the ground surface. An updated version of the USGS model (1) was used as a key component in the feasibility study to evaluate several remediation alterative, including no action. 3 refs., 11 figs., 4 tabs.

45360 Effects of physical, chemical, and biological variability in modeling organic contaminant migration through soil. DiGiulio, D.C. (Drexel Univ., Philadelphia, PA (USA)); Suffet, I.H. pp. 132-137 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The major limitations on the performance of unsaturated (vadose) zone models to predict organic contaminant migration through soils are the inadequacies of the descriptions that define environmental processes and the difficulties in obtaining representative input parameters. One can better observe these limitations by understanding the fate and transport mechanisms affecting contaminant migration and by the development of an awareness of the spatial and temporal variability of the important input parameters. The model limitations can be accommodated somewhat by selecting vadose zone model(s) best suited for a site-specific application, and utilizing input data more representative of actual site conditions. Guidance is presented to aid in both understanding environmental processes and minimizing the limitations of vadose zone models. 82 refs., 1 tab.

45361 Observed rates of biotransformation of chlorinated aliphatics in groundwater. Silka, L.R. (Hydrosystems, Inc., Falls Church, VA (USA)); Wallen, D.A. pp. 138-141 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The biological transformation of chlorinated aliphatic hydrocarbons has been well documented in laboratory studies, but has been reported for only a few field cases. These circumstances are surprising considering the number of sites under study involving chlorinated aliphatics. In contrast to the controlled laboratory experiments, the interpretation of field data to deduce rates of biotransformation is complicated by variable nutrient substrate availability, differential retardation of parent and daughter compounds, and complexity of source geometry and migration pathways. A case study of a sand and gravel outwash aquifer located in Tacoma, Washington is presented. Analyses of groundwater near the site, containing dissolved 1,1,2,2-tetrachloroethane (TET), trichloroethene (TCE), 1,2-cis- and 1,2-trans-dichloroethene (c- and t-DCE) and vinyl chloride (VC), have been used to evaluate biotransformation rates. The concentrations of DCE and VC and the ratios [vc]/[TCE] and [VC]/[t-DCE] increase along the flow path from the site. This pattern is indicative of biotransformation by sequential dehalogenation of TCE to DCE to VC. The TCE biotransformation rate of 10^{-4}/hr reported from laboratory experiments is supported by this analysis. In addition, the reported observation that DCE and VC have longer half-lives than TCE, i.e., slower biotransformation rates, has been supported and a rate of 10^{-5}/hr has been estimated for the field case. 12 refs., 4 tabs.

45362 Estimating dermal exposure from soil using the fugacity approach. Kissel, J.C. (Indiana Univ., Bloomington (USA)); McAvoy, D.R. pp. 142-144 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Experimental evidence useful in the estimation of dermal absorption of xenobiotics from soil remains very limited. The evidence that is available suggests that the fugacity approach is applicable. Thermodynamic gradients and corresponding mass transfer coefficients in a soil exposure experiment are examined. Observed and estimated parameters are compared. Dermal exposure is incorporated in a physiologically based pharmacokinetic model permitting simultaneous analysis of multiple exposures. Dermal bioavailability is predicted to be dependent upon the duration and nature of the exposure and properties of the soil. Dermal uptake is also dependent upon the relative level of contamination in the soil. 17 refs., 1 fig., 5 tabs.

45363 Environmental asbestos: Problems associated with PLM soil analysis. Decker, J.A. (Environmental Protection Agency, San Francisco, CA (USA)); Woo, N.; McDonald, A.M. pp. 145-151 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Experience with laboratories and a review of data generated through the Superfund process confirm a lack of standardized sample preparation techniques and counting rules using Polarized Light Microscopy for asbestos-laden soil samples. Variation in analytical procedures reduces comparability of data generated by different laboratories. The absence of a standardized analytical technique

makes decision-making difficult and may be affecting remedial consistency from site to site. As such, PLM soil results should be limited in use to characterization of spatial boundaries of contamination and for preparation of qualitative risk assessments. Extrapolation from soils data to quantitative risk assessments is not recommended until an adequate standardized methodology for the analysis of asbestos in soils has been adopted. National research needs are highlighted. 67 refs., 6 tabs.

45364 Use of geophysical diffraction tomography for hazardous waste site characterization. Mahannah, J.L. (Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD (USA)); Witten, A.J.; King, W.C. pp. 152-156 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The accurate characterization of hazardous wastes sites is a critical problem impacting their management and cleanup. For this reason, considerable research has been devoted to the development of techniques to improve the capability for site characterization. An example of recent efforts to enhance site assessment capabilities is the development of geophysical diffraction tomography (GDT), a remote sensing technique with the capability to produce a high resolution subsurface image. The use of GDT in subsurface imaging discussed in this paper is based on the projection of an applied acoustic wave through a subsurface cross-section to a hydrophone array located vertically in a borehole. The amplitude of the propagating wave is measured at each hydrophone against time, and subsurface features are reconstructed through application of diffraction tomography theory. The development of the technology for hazardous waste site characterization was accomplished by: conducting a review of diffraction tomography theory, developing data acquisition and reduction procedures to be employed in a field-implementable procedure, and developing and testing the integrated process in the field. This paper describes this development of GDT as a remote sensing technology for the characterization of hazardous waste sites. Field tests to optimize data management and analysis and findings of larger-scale demonstrations of GDT are described. 6 refs., 9 figs.

45365 Credibility of laboratory data for decision-makers. Einerson, J.H. (Sandia National Labs., Albuquerque, NM (USA)); Pei, P.C. pp. 157 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This study was initiated to select reliable, competent laboratories which could perform analyses of wastewater contaminants for the purpose of regulatory compliance. Ten laboratories were selected to participate in the competency tests. In addition to reviews of quality assurance plans, the laboratories were given check samples to-test the accuracy and precision of their analytical techniques. The check samples were spiked with six inorganic contaminants commonly found in wastewater discharges; these samples were sent along with other routine wastewater samples. Each of the laboratories was sent a letter which accompanied the samples specifying handling instructions. This seminar describes the procedures which help in identifying those laboratories that provide precise and accurate analytical services on a consistent basis. The laboratories' qualifications were based on six criteria: ability to customize reports, turnaround time, cost, precision and accuracy from the analyses of check samples, and evaluation of quality assurance documents. Each laboratory was scored and ranked by criteria; the overall scores produced a list of laboratories ranked in order of competence.

45366 Subsurface contamination screening by combined soil gas/groundwater survey procedure. Taylor, L.R. (Earth Technology Corp., Houston, TX (USA)); Berzins, N. pp. 158-163 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The conventional soil gas survey was developed in recent years to investigate subsurface contamination from volatile organic compounds by measuring the concentration of their vapors in shallow soils. Conventional methods involve inserting probes 1 to 3 m. into the vadose zone in order to extract soil gas samples for analysis by gas chromatography. This method has been successful for sites where the groundwater table is shallow, and where there are no restricting layers (clays) which inhibit the diffusion of vapors to the surface. Sampling soil gas at depth, from just above the water table, enables better contaminant plume definition. Since the purpose of the soil gas survey is to define a plume in the groundwater, the more direct method of obtaining groundwater samples and screening their headspace is considered to be more desirable and will result in more representative data. At The Earth Technology Corporation, a unique soil gas and groundwater headspace survey method has been developed and utilized on a number of sites. Cone penetration testing (CPT) trucks, specially designed probes, and a mobile laboratory have been used to obtain both soil gas and groundwater samples cost-effectively and reliably. The CPT-mounted probes can penetrate to a depth of more than 30 m., depending on site conditions, to collect soil gas and groundwater samples. Earth Technology's system also allows profiling of the vertical distribution of volatile organic compounds in subsurface soils and groundwater. The ability to do vertical profiling will result in preliminary delineation of the three-dimensional aspects of plumes in the vadose zone and groundwater early in a site investigation. This system has been successfully applied at a number of sites to delineate petroleum hydrocarbon and chlorinated hydrocarbon plumes. 12 refs., 9 figs., 1 tab.

45367 Comparison of landfill gas testing and groundwater monitoring results from eight former landfill disposal sites at Mather Air Force Base, Sacramento, California. Barkdoll, M.P. (IT Corp., Knoxville, TN (USA)); Bradley, A.; Owens, W.W. pp. 164-173 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The results from a comprehensive landfill gas testing and groundwater monitoring program at eight former landfill disposal sites at Mather AFB, Sacramento, California are presented. Soil gas samples (landfill gases) were collected directly from the refuse (if present) and analyzed for eight chlorinated volatile organic compounds plus benzene and fixed gases (CO_2, O_2, N_2 and CH_4). Groundwater samples were collected from down gradient wells and analyzed for chlorinated volatile organics and aromatic volatile organics with the primary contaminant of interest being trichloroethylene. Although the soil gas samples were collected approximately 2 yr. after the groundwater samples, it is believed that due to the age of the landfills (i.e., 14 to 46 yr.) the time disparity should not materially effect the data interpretation. Data analysis includes the interpretation of the soil gas, fixed gas analysis results with respect to the stage or phase of the landfill life cycle. The correlation between the presence of volatile organics in soil gas samples versus groundwater samples is discussed, and a case study of two sites is presented. 12 refs., 2 figs., 11 tabs.

45368 A rapid purge-and-transfer field screening technique for volatile organic compounds in groundwater. Hein, J.C. (Brown and Caldwell Labs., Emeryville, CA (USA)). pp. 174-176 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Brown and Caldwell laboratories has developed a rapid screening technique for Volatile Organic Compounds (VODs) in groundwater. The technique determines the total concentration of VOCs in a sample in as few as 30 sec. Sensitivity ranges from 10 to 100 μg/l VOC with virtual elimination of carryover from sample to sample. The technique is readily adapted to be selective for aromatic VOCs or for halogen-, nitrogen-, or phosphorus-containing VOCs. The technique involves the direct transfer of purged VOCs from an aqueous sample into a gas chromatographic detector. The flame ionization detector (FID) is used for total VOCs. Selective detectors are used for VOCs containing specific functionality. Results

are semi-quantitative. An appropriate VOC is used as an external calibration standard. The VOC screening technique is effective in the laboratory and has many field applications. In the laboratory, samples targeted for VOC analysis by US EPA methods 8010, 8020, or 8240 are screened to determine sample size. The proper choice of sample size reduces instrument downtime, false positives from carryover, and unproductive repetitive runs. Screening costs are minimal when compared to the gain in capacity and efficiency. Real-time information is crucial to effective decision-making during field operations. The VOC screening technique provides the capability for monitoring VOCs in the groundwater on-site. The apparatus is configured for screening discrete samples or for continuous on-line monitoring. Applications range from well purging prior to sample collection to pumping tests for extraction well performance to startup of unit processes for VOC removal. 3 figs.

45369 **The 3-D model CSUGAS: A management tool for the design and operation of soil venting systems.** Sabadell, G.P. (Colorado State Univ., Fort Collins (USA)); Eisenbeis, J.J.; Sunada, D.K. pp. 177-182 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In-Situ Volatilization (ISV) or soil venting has proven to be an economic, simple and effective method for the removal of volatile organic compounds which have been spilled or leached into the soil. In the past, when ISV has been applied to a site, very little if any work was done in characterizing the system and predicting how it was to operate. This was mainly due to the lack of understanding of the dynamics of soil venting. CSUGAS is a three-dimensional model, which has been developed at Colorado State University, for numerically simulating the flow field of compressible gas in a porous medium due to artificial influence. With the aid of a model such as CSUGAS, the process of determining the applicability of ISV to a specific site, designing the most efficient system and selecting the best operating conditions of the system is greatly facilitated. CSUGAS has proven to be an effective management tool for the design, analysis and operation of ISV systems. The CSUGAS model has been used to characterize and evaluate an ISV system which is currently operating at the US Army Twin Cities Army Ammunition Plant for the removal of trichloroethylene from the soil overlying an aquifer. This paper presents the methodologies used to apply CSUGAS for the analysis of the Twin Cities Army Ammunition Plant site and the results obtained. Based on various CSUGAS simulations, it is shown that under alternate operational and design scenarios the ISV system may be more effective. 3 refs., 8 figs.

45370 **Compressed gas cylinder disposal alternatives.** Gold, J.W. (Integrated Environmental Services, Atlanta, GA (USA)). pp. 183-187 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

As hazardous waste site remedial activity increases across the US in both the private and governmental sectors, the problem surrounding disposal of known and unknown compressed gas cylinders continues to grow. In the past, disposal of compressed gas cylinders with both known and unknown contents has been accomplished through high-speed projectile penetration (shooting the cylinder), detonation using shaped charges, and direct venting to the atmosphere. In contrast, acceptable disposal alternatives for compressed gas cylinders and aerosol canisters currently available include: Incineration; Chemical Treatment; Open Burning/controlled detonation; Manufacturer Reclamation; and Subsurface Injection. All commercial disposal options are dependent on identification of the gas. Obtaining a sample for the purpose of identification may pose serious problems when the cylinder containing the gas is in deteriorated or otherwise altered condition. Specialized robotic equipment is available and may be utilized to safely sample and identify the contents of compressed gas cylinders before disposal. This paper briefly examines past pressurized container disposal practices, presents an inventory of existing commercial disposal alternatives, and explores an available technology for processing deteriorated compressed gas cylinders.

45371 **Expedited response action to remediate VOC contamination.** Smith, C.W. (Environmental Protection Agency, Kansas City, KS (USA)); Kiefer, M.L.; Skach, R.F. pp. 188-192 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The US EPA and the REM II Remedial Contract team performed an Expedited Response Action (ERA) to initiate remediation of groundwater contamination at the Waverly, Nebraska Superfund site in response to volatile organic contamination of the public drinking water supply. The source was identified as a former Federal Grain Facility where carbon tetrachloride was used as a fumigant to protect grain being stored. In March 1987, the U.S. EPA tasked REM II to perform an ERA including focused site investigations and initial response actions as identified during performance of an Engineering Evaluation and Cost Analysis. The ERA work was completed within budget and the 1-yr. statutory time limit, including 2 months of successful operation of the treatment facility. The ERA treatment systems were designed, constructed and started up in January 1988 under a fast-track program, including the following components: Vapor extraction system (VES) wells manifolded to a vacuum system designed to remove a maximum of 270 cfm. of contaminated soil gases from the source area; A groundwater extraction well installed on-site to initiate recovery of contaminated groundwater; An air stripping system designed to reduce carbon tetrachloride concentrations in the extracted groundwater from 4,000 ug./l. to 5 ug./l. After 6 months of operation, the contamination concentration in the influent groundwater has been reduced by over 50%; and the air stripper removal efficiency for carbon tetrachloride is in excess of 99.8%. The vapor extraction has also effectively removed VOC contaminants from the vadose zone. 9 figs.

45372 **Assessment of site remediation technologies in European countries.** Nunno, T.J. (Alliance Technologies Corp., Bedford, MA (USA)); Hyman, J.A.; Pheiffer, T. pp. 193-198 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Site remediation is a pressing issue in European countries due to limited availability of land. Therefore, much progress is being made in the development of effective technologies for remediating contaminated sites. The purpose of this program was to investigate the most successful and innovative technologies for potential application into US markets. This EPA-sponsored project was based on a 9-mo. research effort which identified 95 innovative technologies in use or being researched in foreign countries. The most promising technologies were studied in-depth through personal interviews with the engineers who research and apply these technologies; and tours of laboratory models and full-scale installations were also taken. The most successful full-scale technologies investigated were developed in Holland, West Germany and Belgium. These technologies include vacuum extraction of hydrocarbons from soil, in-situ washing of cadmium-polluted soil, rotating biocontactors for treating pesticides in groundwater, high-temperature slagging incineration of low-level radioactive wastes, in situ steam stripping, and a number of land farming and soil washing operations. The paper provides descriptions of 13 site remediation techniques that have shown such promise in laboratory studies or in practice to warrant consideration of their use in the US. 9 refs., 2 figs., 6 tabs.

45373 **Comparison of sealed double ring infiltrometer and laboratory derived permeability values for closure of a superfund landfill.** Pedersen, T.A. (Camp Dresser and McKee, Inc., Boston, MA (USA)); Vitale, J.; Gallagher, J. pp. 199-201 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The permeability of the soil/bentonite layer of the composite closure cap for the Western Sand and Gravel Superfund site in Burrilleville, Rhode Island, was measured utilizing an in situ sealed double-ring infiltrometer and standard laboratory techniques. The

cap is comprised of a 40-mil high density polyethylene (HDPE) flexible membrane liner over a compacted layer of low permeability soils and bentonite. Sand sub-base, drainage layers and topsoil components are also integral parts of the composite cap. The low permeability soil layer was constructed using fine washings from a local sand and gravel operation to which powdered and pelletized bentonite was added. The party conducting the closure operations undertook an extensive laboratory evaluation program during the design of the cap to determine optimum washing/bentonite mix ratios, moisture content and compactive effort required to achieve a permeability of 1×10^{-7} cm/sec. In addition to the preliminary laboratory evaluation, the moisture-density relations, washing/bentonite mixing techniques and compaction procedures were refined further by constructing a 24-ft by 60-ft test cell. The cell was constructed using screened washings on one half of its area and the other half was constructed using unscreened washings to evaluate if any difference in permeability would be achieved. Two lifts were each mixed separately with 10% by weight bentonite, rototilled to mix the soil washings and bentonite, and compacted to a final cap thickness of 6 in. The permeability of thin wall tube samples obtained from the test cell was analyzed in the laboratory prior to construction of the actual site cap. As an independent check on the permeability, in situ sealed double-ring infiltrometer tests were also performed on the test cell by Camp Dresser and McKee Inc., as technical oversight contractors to US EPA. 4 refs., 2 figs., 3 tabs.

45374 The Nike Missile system: An environmental legacy. Lovett, J.T. (Army Corps of Engineers, Anchorage, AK (USA)); Denfeld, D.C. pp. 202-207 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In 1984, the US Army Corps of Engineers launched its cleanup program of formerly used military bases. The expectation was that little hazardous-toxic-waste (HTW) would be encountered at the abandoned World War II sites. There were fears that serious HTW contamination might be discovered at the Cold War era facilitates such as the Nike missile bases, the DEWLine radar sites and other radar and communications sites built in the post-war years. Contamination at Nike sites could include UDMH, solvents, IRFNA, and radioactive releases. Extensive sampling was therefore accomplished at four Alaska Nike bases. The findings demonstrate HTW contamination of a level and substances similar to that discovered at the World War II bases. The sources of contamination also resemble the World War II locations. The contaminants are hydrocarbon-stained soils associated with fuel spills and PCB contamination from vandalized electrical transformers. Nike Site Tare outside of Fairbanks, Alaska is representative of this finding. Here, soil around an underground storage tank was contaminated by overfilling the tank sometime during its use. Today this contamination poses a danger to the drinking water of a recreation area that now surrounds the former missile launch site. A soil treatment program that includes removal of stained soil and aeration has been initiated. A water well monitoring program also has been launched. 8 refs., 4 figs., 1 tab.

45375 Evaluation of Nike site confirmation studies. Smith, L.A. (Law Environmental, Inc., Kennesaw, GA (USA)); Mungin-Davis, Q.; Bennett, D. pp. 208-213 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The US Army Corps of Engineers (USACE) has the responsibility of performing confirmation studies at over 300 former Nike missile sites throughout the continental US to determine whether or not each site is contaminated with toxic or hazardous wastes. This paper presents the results of a recent project to review and evaluate the existing data on 30 former Nike sites and, based on this evaluation, assesses the potential for contamination at Nike sites. The results of this assessment were used to evaluate the need for confirmation studies at Nike sites and to recommend a procedure to determine which, if any, of the remaining Nike sites warrant a confirmation study. This project resulted in the recommendation that the USACE adopt a risk-based approach to determine which Nike sites warrant a confirmation study. The recommended approach is based on the New York Department of Health's Human Exposure Potential Ranking Model. This model was used to prioritize the 30 sites included in this study in terms of the potential for adverse impacts on human health as a result of exposure to contaminants at the sites. The USACE currently is considering the adoption of the recommended risk-based approach for prioritizing all of the remaining Nike sites. Adoption of this recommendation into an integrated program for addressing potential contamination at all former Nike sites will result in a substantial savings to the USACE in terms of both money and manpower. The recommended approach will also increase confidence that the USACE is adequately addressing potential human and environmental risks at each of the former Nike sites. 7 refs., 4 figs., 2 tabs.

45376 ARCS [Alternative Remedial Contract Strategy]: A performance based strategy. Smith, J. (Environmental Protection Agency, Washington, DC (USA)); Saracina, R.; Salisbury, C. pp. 214-218 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Alternative Remedial Contract Strategy (ARCS) is the US EPA's updated approach to obtain project management and technical services to support remedial response activities at NPL sites'. Site specific technical services include remedial planning, remedial design, remedial implementation, and various technical support activities. The successful implementation of ARCS contracts will phase out the existing Remedial Planning (REM) contracts. ARCS contracts differ from REM contracts in that ARCS incorporates innovative performance incentives that will maintain competitive pressures on contractors throughout the 10-yr. period of performance. EPA is selecting pools of qualified ARCS contractors in each region through a standard competitive process. The subsequent annual allocation of work assignments among the prequalified pools is accomplished through a structured review of evaluation factors including conflicts of interest, specific expertise, contract capacity, proximity to the project site, and technical performance on ARCS assignments. The primary factor used to determine the quantity of work assigned to each contractor will be performance. Performance ratings are based on a well-established award fee performance reporting and rating system. The relative performance rating of each contractor is directly proportional to the number of work assignments awarded. This work assignment allocation process sustains a competitive environment among the ARCS contractor pools and provides significant incentives to maintain quality performance for the duration of the contract. This paper discusses the award fee and work assignment allocation procedures of ARCS and outlines the performance reporting and rating system used for both award fee determination and work assignment distribution. This paper will introduce the Performance Index Rating Score (PIRS) and how it is used to allocate work assignments. 3 figs., 1 tab.

45377 Remedial planning at an uncontrolled hazardous waste site in Theresienfeld, Austria. Rudy, R.J. (Ecology and Environment, Inc., Tallahassee, FL (USA)); Marszalkowski, R.A.; Bayer, H. pp. 219-225 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Republic of Austria recently implemented its first full-scale remedial program at an uncontrolled hazardous waste landfill. Because of lack of experience in hazardous waste site remediation, Austria consulted with an Austrian-American environmental sciences and engineering team experienced in such work and accustomed to US EPA procedures and guidelines. However, since Austria also lacks comprehensive hazardous waste legislation, and EPA regulations obviously do not apply in Austria, a fast-track feasibility study and design process and selective adoption of EPA procedures and guidelines was possible. The landfill, in the small community of Theresienfeld, about 30 km. south of Vienna, contains several thousand drums of waste solvents mixed with municipal garbage. The waste solvents have since entered the aquifer and contaminated the local drinking water of the Theresienfeld

area. These wastes were dumped on the site between 1972 and 1985. The landfill site was initially a surface gravel mine. When mining was no longer profitable, the site was sold to an entrepreneur who began landfill operations, but without the use of contaminant migration prevention techniques such as the installation of liners, leachate control or gas control. The landfill is situated in the southern portion of the Vienna Basin, a large trough-shaped depression created by classic horst and graben tectonics. Characteristic sediments in this part of the basin consist of Tertiary-age clay materials covered by 100 to 150 m. of Quaternary gravel at the surface. Groundwater flow velocities within the gravel range from 6 to 20 m./day along the longitudinal axis of the graben structure. Leachate from the landfill has seeped into this aquifer and resulted in organic contamination of several nearby down gradient monitoring, industrial, and drinking water wells. 3 refs., 4 figs., 1 tab.

45378 Expedited response action at a treatment facility. Schmierer, K.E. (Tetra Tech, Inc., Bellevue, WA (USA)); Virgin, J.J.; Johnson, T.L. pp. 226-233 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In December 1986, the US EPA Region X initiated an investigation to assess contamination and evaluate alternatives for the Expedited Response Action (ERA) at the Wyckoff Company facility on Bainbridge Island near Winslow, Washington. The facility treats pilings and poles, using creosote as the preservative; a pentachlorophenol/oil mixture has also been used at the facility. The purpose of the ERA was to mitigate the seepage of contaminants into Puget Sound from the intertidal zone surrounding the site. The ERA field investigation involved multimedia environmental and feedstock sampling. Results of the sampling program were examined to define the nature and extent of contamination in surface soils, subsoils, groundwater, and intertidal seeps and to evaluate contaminant sources. Extensive subsurface contamination was encountered at numerous drilling locations. Concentrations of chemicals in many of the environmental samples exceeded the State of Washington Extremely Hazardous Waste and Dangerous Waste criteria. A public health and environmental risk assessment was conducted to assist in the evaluation of remedial alternatives. The evaluation of remedial actions included screening available remedial technologies, profiling viable technologies, and assembling remedial alternatives. The preferred alternative involves installation of barrier wells to offset tidal influence on groundwater levels and to create an inward directed hydraulic gradient, active recovery of floating product, and groundwater treatment. Remedial actions for source control at the active facility are being instituted prior to implementation of the preferred alternative. 10 refs., 8 figs., 4 tabs.

45379 Innovative industrial compliance program a no migration variance. Donaloio, B. (Monsanto Co., Alvin, TX (USA)); Connor, J.A. pp. 234-240 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

An industrial wastewater pretreatment system, composed of three large earthen surface impoundments, was subject to the minimum technological requirements (MTR) of the Hazardous and Solid Waste Amendments (HSWA). The surface impoundments collect and pretreat process wastewater and contaminated storm water from a chemical manufacturing operating unit. Under HSWA, an exemption to liner retrofitting requirements is provided if it can be demonstrated that the facility, based on location, design, and operating practices, would not allow the migration of hazardous constituents into the zone of soil saturation at any future time. Based on conversations with the US EPA, the critical technical parameters of the no migration demonstration were identified. A field program was developed to provide hydrogeologic data on the soils adjacent to the surface impoundments and support analysis of potential leachate migration through the unsaturated soil zone. Appropriate methods for characterization of critical modeling parameters, including soil moisture profile, chemical retardation, and biodegradation effects, were defined. The performance of the existing clay liner was modeled using a one-dimensional, unsaturated flow model developed by the University of Florida Institute of Food and Agricultural Sciences. Statistical analyses were conducted to distinguish between field and laboratory variability and define the 95% confidence limits for saturated hydraulic conductivity. The study concluded that the permeability of the unsaturated clay soils underlying the surface impoundments is uniformly low; that there is no evidence of leakage; and that hazardous constituents will not migrate to the depth of the underlying saturated soil zone within the life of the facility. EPA approved this variance to the HSWA liner retrofitting requirement. 11 refs., 8 figs., 6 tabs.

45380 Technical regulatory, institutional and community issues effecting the remedy selection process. Pimentel, E. (Camp Dresser and McKee Inc., San Francisco, CA (USA)). pp. 241-244 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

CERCLA as amended by SARA drafted a process whereby there are general rules to select a remedy, a 5-yr. review period to assess the adequacy of the remedy, and minimum cleanup requirements to be met by the remedy. To meet the intent of SARA, innovative proven technologies need to be considered in the RI/FS process if they show sufficient promise of reducing risk; reducing mobility, toxicity, or volume (MTV); or offering a permanent solution. The technologies, if they are to be considered acceptable under SARA, must also meet applicable or relevant and appropriate requirements (ARARs), and the community must be given an opportunity to participate in the remedy selection process. The remedy must further, to the maximum extent practical, be cost-effective. The determination of cost-effectiveness must take into account short- and long-term impacts of the remedy as well as operation and maintenance requirements necessary for the anticipated duration of the remedy. This paper will present a private consultant's perspective some based on Superfund site experience of how the remedy selection process is affected by technical, regulatory, institutional, and community issues. The process to be reviewed will focus primarily on the feasibility study which is defined as consisting of three phases. Phase I. Overview of site history, nature and extent of contamination; identification of remedial criteria, and development of remedial objectives which are consistent with SARA. Phase II. Development and screening of conceptual remedial alternatives, and associated remedial technologies. Phase III. Detailed analysis of remedial alternatives using the nine criteria recommended under the EPA guidance for compliance with SARA. 4 refs.

45381 Engineering a pond closure. Bracken, B.D. (Brown and Caldwell, Pleasant Hill, CA (USA)); Esmaili, Houshang; Moayer, M. pp. 245-250 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The paper describes details on the closure of a 7-ac. surface impoundment owned by Pinole Point Properties, a subsidiary of Marwais Steel Company. The site is located in an environmentally sensitive area in Richmond, California. A previous site owner used the impoundment as an evaporation and settling basin for wastewater discharged by a hot-dip galvanizing operation. Initial site investigations revealed zinc and lead concentrations in soil, surface water and groundwater high enough to be of concern to the California regulatory agencies. Pinole Point Properties retained Brown and Caldwell to conduct a detailed site investigation to define the nature and extent of the contamination problem before closing the pond. The project progressed through several additional phases which involved extensive interaction with regulatory agencies, development of a closure plan to meet agency requirements and achieve owner objectives, design of the selected closure alternative, construction of an engineered cap and long-term groundwater monitoring of the closed site. 7 figs., 3 tabs.

45382 How to save time and money during PCB site remediation. Marsh, D.T. (Remcor, Inc., Pittsburgh, PA (USA)); Ianniello, M.L. pp. 251-254 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Screening methods can represent significant savings in time and expense during the investigation and remediation of sites contaminated With PCBs. This paper presents data from three field investigations of PCB-contaminated sites and evaluates the field performance of a quick-screen method for the analysis of PCBs in soil. The objective of each site investigation was to determine the vertical and areal extent of the PCB soil contamination preliminary to excavation and removal of soils contaminated above a prescribed concentration level. At two of the sites, the field method was also used to verify that the target cleanup criteria had been achieved once remediation was complete. The quick-screen method used was the Kwik-Skrene Analytical Testing System, manufactured by Syprotec Inc. Kwik-Skrene is a semi-quantitative colorimetric analysis capable of determining the total chlorine extracted from a variety of media (including soil) above and below a pre-selected concentration level or cleanup criterion. The field screening results were also used at two sites to target samples for additional laboratory testing. The collected samples were carefully mixed and split into two fractions. One fraction was analyzed using Kwik-Skrene in the field; if the field analysis indicated the PCB concentration on the sample was below the target level, then the split fraction was analyzed by a laboratory using conventional gas chromatography techniques for the quantitative determination of PCB concentration. This paper presents field and laboratory data from the three sites. Conventional analytical costs are compared with total PCB analytical costs using Kwik-Skrene in the field. Cost factors include sample collection and record keeping time, shipping charges, and potential cost penalties for quick turnaround time on conventional analyses, analytical costs, and labor and equipment charges waiting for results. 1 fig., 4 tabs.

45383 Times beach remedy selection. Feild, R.W. (Environmental Protection Agency, Kansas City, KS (USA)); Sarno, D.J. pp. 255-258 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In February 1983, the town of Times Beach, Missouri captured the nation's headlines and crystallized our greatest fears about hazardous waste. Roadways throughout Times Beach were found to be contaminated with 2,3,7,8 tetrachlorodibenzo-p-dioxin, a highly toxic compound. As a result, the US EPA elected to permanently relocate the 2,242 citizens of the town to eliminate the immediate health risk Feed. In addition to Times Beach, 25 other sites in eastern Missouri were found to have levels of dioxin presenting a health risk. The largest of these sites have been listed on the NPL, while the majority of the smaller sites have not. Since 1983, the US EPA has performed cleanups at a number of these sites, using the removal program to excavate and temporarily store dioxin-contaminated soils. Detailed investigations have been performed at Times Beach and other sites to define and quantify the amount of waste and resulting risk at these sites. More response actions are planned and EPA hopes to culminate these efforts in a comprehensive action to provide a final remedy for Times Beach and all eastern Missouri dioxin sites. EPA is proposing a final remedial action to clean up the Times Beach and Minker/Stout/Romaine Creek Superfund sites and provide capacity for treatment of all eastern Missouri dioxin soils from NPL and non-NPL sites alike. The remedy includes siting a thermal treatment unit at the Times Beach site to burn soils to be excavated at Times Beach and soils already excavated from the Minker/Stout/Romaine Creek site which are currently in storage. Soils from other sites would be treated at Times Beach as determined on a site-by-site basis. Sites will be cleaned up according to recommendations made by Federal and state health agencies based on the projected land use. Institutional controls in the cleanup process will assure that future land use remains consistent with the level of cleanup. 1 ref.

45384 Application of engineering under uncertainty to remediation of hazardous waste sites. Brown, S.M. (CH2M Hill, Bellevue, WA (USA)); Lincoln, D.R.; Wallace, W.A. pp. 259-260 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Uncertainty is a key technical factor in Superfund remediations. It can lead to unreasonable data gathering exercises if the point of diminishing information returns is not recognized. Engineering under uncertainty, however, is not unique to Superfund, and approaches have been used elsewhere to recognize and respond to substantial uncertainty. The observational method, traditionally applied in geotechnical engineering, has a number of key elements applicable to Superfund remediation. The key contributions of the observational method are: (1) remedial design based on most probable site conditions; (2) identification of reasonable deviations from those conditions; (3) identification of parameters to observe so as to detect deviations during remediation; and (4) preparation of contingency plan for each potential deviation. This paper describes an approach to incorporating the observational method within the current Superfund process, and provides a detailed discussion of that process in the context of groundwater remediation. When uncertainty is explicitly recognized in a proper application of the observational method, the process offers the opportunity to reduce project time and costs as well as risks.

45385 Assessment of a passive treatment system for acid mine drainage at a Colorado Superfund site. Chappell, R.W. (Camp Dresser and McKee, Inc., Denver, CO (USA)); Olsen, R.L.; Wildeman, T.R.; Laudon, L.S. pp. 261-264 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Drainage from abandoned precious/base metal mines with characteristically high metals concentrations and a low pH, discharges into several streams in the Colorado front range. Due to the predicted high costs associated with conventional chemical treatment systems for these mine waters, an alternative remediation technology is being investigated at the Clear Creek/Central City Superfund Site. This alternative is construction or improvement of natural wetland-based passive treatment systems which utilize native plants, substrates, and rock materials to neutralize pH and remove heavy metal contaminants via adsorption, precipitation, plant uptake, and oxidation-reduction reactions. The effectiveness and applicability of the wetland system was assessed by a pilot plant designed and constructed to treat approximately 15% of the total discharge from a representative mine at the site. Outflow from and subsurface flow through the pilot plant (which is divided into three unconnected treatment compartments for evaluating various different substrate materials) is being monitored at regular intervals to assess any seasonal effects on the treatment system. The results during the first year of operation show significant decreases in many contaminants and neutralization of pH. The compartment utilizing mushroom compost as a substrate appears to be the most effective of all processes, with reductions in dissolved concentrations of greater than 53% aluminum, 66% cadmium, 69% chromium, 97% copper, 85% lead and 45% iron, and pH increases from 2.5 to greater than 6.0 occurring over selected months. The results of the pilot plant study indicate that the wetland-based passive treatment approach is a viable alternative for the treatment of acid mine drainage in the area. 9 refs., 2 figs., 2 tabs.

45386 Raintree Village: Typical new suburban housing development turned not-so-typical superfund site. Yancheski, T.B. (Tetra Tech Richardson, Newark, DE (USA)). pp. 265-268 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

On Sept. 24, 1987, methane was discovered seeping into homes in a new housing development known as Raintree Village, located near Newark, Delaware. Methane, in concentrations in excess of the lower explosive limit, was detected in 12 homes and surrounding soil areas. Following initial emergency response, which included evacuation of homes and explosion risk remediation by Delaware Department of Natural Resources and Environmental Control (DNREC) and US EPA Region III Technical Assistance Team (TAT) personnel and subcontractors, numerous investigations were conducted to identify the source and extent of the methane at the site. Methane was discovered to be emanating from debris pits

which were located adjacent to the homes. The debris pits were filled with trees, tree stumps, and wood from site clearing activities prior to and during construction of the housing development. The methane at the site was being generated as a result of the abnormally rapid decomposition of the tree and organic material due to unusual site conditions. Following the identification of the source and extent of the methane, a number of remedial recommendations were evaluated, and one remedial measure was chosen by a panel of local residents, US EPA, DNREC, and other local environmental officials. Complete removal of the debris in the pits was chosen to eliminate the hazard of the methane. Following a breakdown in negotiations for cleanup to be conducted by the PRP, DNREC requested Federal Superfund resources to expedite the remediation of the methane problems at the site. In January 1988, the site was authorized for remediation utilizing Superfund resources, and project management was assumed by US EPA. Cost of remediation is expected to be greater than $1.0 million. 1 ref., 2 figs.

45387 **Communicating with the public at potential NPL sites: A case study of Westminster, California.** Shapiro, M.F. (Environmental Protection Agency, Washington, DC (USA)); Wells, S.; Millison, D.; Stetz, E.; Richey, M. pp. 269-272 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Superfund Amendments and Reauthorization Act of 1986 (SARA) requires the US Environmental Protection Agency (EPA) to revise the Hazard Ranking System (HRS) to more accurately assess the relative risk of sites, to the extent feasible, as well as to consider contamination of the human food chain, drinking water wells, surface water, and ambient air. The HRS is the primary way of determining if waste should be on the National Priorities List (NPL). EPA expects that the revised HRS will affect the types of data collected during a site inspection, particularly with respect to sampling of: residential soil (to assess on-site exposure); residential wells; municipal wells; and surface water intakes. Because of the expected expansion in sampling activities, EPA Regions and States may need to initiate community relations activities at earlier stages for certain potential NPL sites being investigated in the Superfund program. This paper is a case study of a site inspection conducted at a site in Westminster, California, and the community relations issues it posed. The paper briefly discusses the characteristics of this particular site - a housing development built on top of buried trenches of hazardous waste - what samples were collected, and what the community's specific concerns were. Among the issues discussed are planning a community meeting, developing public information materials, coordinating with local officials, and communicating with the community and the press. This case study provides a blueprint for EPA site managers, as well as those from other State and Federal Agencies, on how to handle community relations concerns during pre-remedial activities. 2 tabs.

45388 **The French, Ltd. Project: A case study.** Sloan, R.L. (ARCO Chemical Co., Newtown Square, PA (USA)); Woodward, R.E.; Goldman, N.J. pp. 273 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Within the last decade, an awareness of the limitations and objections of incineration, deep well injection, solidification and similar remediation techniques has compelled a renewed interest in practical methods of biological remediation. With the increasing need to develop vigorous, alternative programs for remediation has come a new awareness of the degradative potential of biological systems. This innovation, for some, is represented by the present or current developing genetically engineered biotechnologies, but is perhaps better represented by innovative old biotechnology reflecting advance in conception and application more than the biotechnology of remediation. Old technologies applied with new purpose, imagination, focus, and control are capable of excellent bioremediation of a wide range of mixed or defined hazardous wastes previously regarded as storable, injectable or incinerable. Because of their novelty and unfamiliarity to regulatory agencies and potential user-clients, larger scale in situ bioremediations have been forced initially to utilize extensive monitoring to demonstrate their efficacy and ability to operate within parameters which do not significantly contribute to or spread air pollution, water pollution or toxicity of the site. With the understanding gained from larger scale in situ bioremediation demonstrations such as the French, Ltd. site, operating criteria can be developed to guide the design of effective remediations with a minimum of efficient monitoring to safeguard the public, the environment and on-site personnel. Reported here is a successful large scale demonstration of an in situ bioremediation of a mixed hazardous waste Superfund site using conventional wastewater technologies and incorporating sound engineering design, innovative applications, careful monitoring and progressive, but not novel, microbiology.

45389 **Determination of the uncertainty in the volume of contaminated soil using probability kriging.** Sullivan, J.A. (Camp Dresser and McKee Inc., San Francisco, CA (USA)); Wieland, K.A.; Teepen, K.L. pp. 274-276 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Recent advancements in the field of geostatistics have led to the development of techniques which are used to estimate the uncertainty in calculated volumes of contaminated soils. In this case study, geostatistical methods were used to estimate the volume and distribution of pentachlorpophenol (PCP) present in soils at a wood treating facility. The facility covers 11 acres and is divided into a wood treatment operations area and a landfill. At the operations area, over 300 soil samples were collected at various depths to investigate the spatial distribution of PCP. Basic statistics and variograms were calculated to investigate the properties of the data. The variogram models were used as inputs to Ordinary and Universal Kriging algorithms to determine the volume of soil exceeding the site-specific action level (25 mg/kg). Observed analytical errors were used to transform the concentration data into probabilistic data. The transformed data were then utilized by an advanced Kriging technique, termed Probability Kriging, to estimate the uncertainty in the estimated volume of contaminated soil. The volume estimate and associated uncertainty statement were used by contractors as a basis for bidding the soil excavation and treatment contract. 6 refs., 2 figs., 2 tabs.

45390 **Use of quantitative risk assessment at hazardous waste sites by potentially responsible parties.** LaGrega, M.D. (Bucknell Univ., Lewisburg, PA (USA)); LeGros, S.P.; Huggins, A. pp. 277-281 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This paper presents the application of quantitative risk assessment from the perspective of PRPs who may ultimately have to pay for the mandated cleanup. The paper provides some definitions of risk assessment and summarizes the protocols used to quantify risk. The legal basis for use of risk assessment at hazardous waste sites is described, along with a summary of recent court decisions on challenging the selected remedy at superfund sites. Finally, two case studies are described illustrating the use of quantitative risk assessment by PRP groups. Risk assessment provides a useful tool for PRPs in influencing decision-making at Superfund sites and preparing for subsequent cost recovery actions. 24 refs., 3 figs.

45391 **A background-based ranking technique for assessment of elemental enrichment in soils at hazardous waste sites.** Eckel, W.P. (Viar and Co., Alexandria, VA (USA)); Langley, W.D. pp. 282-286 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A Background-Based Ranking technique for assessing the enrichment of naturally occurring metals in hazardous waste site soil samples is demonstrated with nation-wide survey data from the Superfund program. The BBR technique removes the ranking bias toward geochemically abundant, high concentration elements. Abundant and rare elements are given equal weight by using relative ranking measures such as the percentage of all samples tested exceeding the upper concentration limits of the 95% and

99% confidence intervals, or exceeding the maximum observed concentration, of the background concentrations of each particular metal in US soils. The technique incorporates information on both the occurrence and the concentration of elements in the waste sites surveyed. Contract Laboratory Program, Inorganics, Chemical Occurrence, Chemical Concentration, Background, Ambient. 10 refs., 4 figs., 5 tabs.

45392 **Remediation cost reduction through risk assessment and development of alternative cleanup levels.** Gleason, P.J. (James M. Montgomery, Consulting Engineers, Inc., Lake Worth, FL (USA)); Kavanaugh, M.C.; Ozbilgen, M.M.; Carroll, P.J.; Bond, L.D.; Blowers, M.A.; Bartel, T.J.; Kuersteiner, J.D.B. pp. 287-291 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Remediation cost reduction measures have been developed for a Florida site experiencing groundwater contamination by volatile organic compounds (VOCs). These cost reduction measures have been approved by the Florida Department of Environmental Regulation (FDER) and have been included in a signed Consent Order. According to the FDER, the alternative cleanup levels developed for this site represent the first alternative cleanup levels (which are above drinking water standards) developed in the state of Florida. Alternative cleanup levels were made possible through the use of both a conservative contaminant transport model and risk assessment. A reduction in the length of remediation was based on the ability to predict concentrations over time at down gradient locations, determine that only minimal risk existed to down gradient receptors and develop acceptable monitoring site and target contaminant concentrations. Six VOCs in the surficial aquifer exceeded FDER maximum contaminant levels (MCLs) but of these, 1,1-dichlorethene (DCE), a possible breakdown product of tetrachloroethene (PCE) and trichloroethene (TCE), posed the greatest threat to receptors. A two-dimensional flow and solute transport model was developed to project the movement of DCE both during 4 yr. of treatment using air stripping and then for 50 yr. following shutdown of the remediation program. The remediation program modeled consisted of 10 recovery wells, an air stripper and four recharge trenches. In the risk assessment, exposure routes investigated included inhalation of vapor, ingestion of water, dermal contact and ingestion of food (seafood from down gradient estuarine Indian River). Down gradient wells were irrigation-only wells with all domestic uses derived from a public water supply system. 6 refs., 2 tabs.

45393 **Risk assessment of incineration of dioxin contaminated soil.** Chrostowski, P.C. (Clement Associates, Inc., Fairfax, VA (USA)); Foster, S.A.; Fogg, A. pp. 292-294 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Both the Superfund NPL listing process and the National Dioxin Study have identified hundreds of sites where soil is contaminated with 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD) or its congeners at levels above the action level of 1 (ppb) which has been recommended by the Centers for Disease Control. For example, in Missouri, there are at least 20 sites where dioxin containing waste materials were sprayed on soil for dust control and where 2,3,7,8-TCDD has been found at levels up to 300 mg/kg in soil. Although many TCDD treatment techniques are available, only thermal treatments such as incineration are capable of treating TCDD-contaminated soil to acceptable levels in a cost-effective fashion. The details of thermal dioxin treatment systems are described elsewhere, and will not be repeated here. Incineration has been questioned as a destruction technique, however, due to a perception that it can act to disperse the materials being incinerated throughout the environment in addition to creating products of incomplete combustion (PICs) which may be toxic in their own right. Risk assessment is a formal analytical tool which can evaluate the potential for human health and environmental impacts of the incineration technology. The purpose of this paper is to present the results of a generic health risk assessment at a hypothetical hazardous waste site where soil contaminated with 2,3,7,8-TCDD is to be remediated by incineration. This quantitative health risk assessment consists of several separate steps, which are discussed in depth below: Development of contaminant emission rates; Air quality modeling; Hazard assessment; Exposure assessment; Risk characterization. 13 refs.

45394 **MEPAS [Multimedia Environmental Pollutant Assessment System] and RAAS [Remedial Action Assessment System] methodologies as integrated into the RI/EA/FS process.** Hartz, K.E. (Washington State Univ., Pullman (USA)); Whelan, G. pp. 295-299 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

To help implement the Remedial Investigation, Endangerment Assessment, and Feasibility Study processes in a more consistent, timely, and cost-effective manner, the Multimedia Environmental Pollutant Assessment System (MEPAS) and the Remedial Action Assessment System (RAAS) can be integrated into the process to: (1) focus on and prioritize the environmental issues at a waste unit; and (2) screen remedial alternatives (synthesized from between 100 and 150 treatment technologies) to ensure that the appropriate environmental issues are addressed and that only the most appropriate remedial alternatives are highlighted for final consideration. The MEPAS methodology is a user-friendly, computer-based endangerment assessment-type system designed to assess environmental issues/problems on the basis of limited site data by performing a physics-based transport, exposure, and health effects assessment. The RAAS methodology is a feasibility study assessment methodology (currently under development) that investigates remedial action alternatives by: (1) integrating unit processes into treatment trains; (2) evaluating each remedial alternative with respect to performance, and; (3) evaluating the potential risk to surrounding sensitive receptors (using the MEPAS methodology) for waste streams associated with each remedial alternative. 10 refs., 4 figs., 1 tab.

45395 **Application of risk management at Wurtsmith Air Force Base, Michigan.** Stirts, H.M. (Headquarters Strategic Air Command, Offutt Air Force Base, NE (USA)). pp. 300-303 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Hazardous waste cleanup efforts have grown significantly in number, complexity and cost. Department of Defense installations face cleanup requirements similar to private industry. Military facilities, which cannot use Superfund monies for abatement activities, rely on the Defense Environmental Restoration Account for funding. However, requirements are rapidly outstripping resources, and environmental managers are often forced to make difficult decisions concerning remedial priorities. The Strategic Air Command (SAC) has utilized a risk management process to assist in establishing cleanup priorities. This process consists of first assessing the risk to human health and the environment, then applying policy issues to assist in selecting an option from various alternatives. This paper discusses the risk management process applied to a SAC base experiencing groundwater contamination. 8 refs., 4 figs., 3 tabs.

45396 **The role of risk assessment and ARARs [applicable or relevant and appropriate requirements] in setting protective cleanup standards at CERCLA sites.** Smith, S.M. (Environmental Protection Agency, Washington, DC (USA)); Zamuda, C.D. pp. 304-312 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The purpose of this paper is to coalesce information regarding Superfund risk assessment and Superfund compliance with applicable or relevant and appropriate requirements (ARARs) in order to portray the current EPA approach to ensuring that selected remedies are protective of human health and the environment as required by CERCLA Section 121 (b). The paper is not a case study; rather, it is based upon the author's understanding of the

current NCP, the draft proposed NCP (existing at the time of this writing), and relevant Superfund guidance documents and policies. The paper also highlights significant issues that remain regarding the how clean is clean? question. 19 refs.

45397 **Heavy black liquor spill in a major waterway.** Roberts, A.W. (Roy F. Weston, Inc., Atlanta, GA (USA)); Norman, M.A. pp. 313-316 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In April of 1987, a one million gallon storage tank 90% full of heavy black liquor, a wood pulping by-product, ruptured catastrophically at a paper mill in the southeast. The liquor washed over its containment berm, contaminating a large area of the mill grounds. Additionally, at least 10,000 gal. of the liquor entered a nearby creek causing a massive fish kill, an increase in pH, and discoloration of the creek. Subsequently, it was discovered that contrary to the expected behavior of the liquor, it was pooling on the bottom of the creek. The US EPA, working with the responsible party, developed and instituted treatment plans to remove the threat from the creek and a nearby river. Once treatment began, the creek recovered quickly. 1 ref., 7 figs.

45398 **The Ashland oil spill of January 1988 - An EPA perspective.** Laskowski, S.L. (Environmental Protection Agency, Philadelphia, PA (USA)); Voltaggio, T.C. pp. 317-322 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Ashland Oil Spill of January, 1988 near Pittsburgh, Pennsylvania was one of the largest inland releases of oil in US history. The response to this release lasted over a month and involved the combined resources of government, industry and the public. This paper discusses the spill incident, the response, and the causes of the release. The inquiry into the regulatory aspects of this incident is continuing and is not a focus of this paper. The major issues brought out in the response to the release were the determination of the cause of the release, the role that the responsible party played in the cleanup efforts, the role of the first responders to the release, and the role that governmental agencies played in maintaining adequate water supplies to the many communities which take their drinking water from the Monongahela and Ohio Rivers. A description of the response to the release and the methods which were used to track the plume and provide early warning to downstream users also is discussed. The Regional Response Team played an active role in coordinating the many governmental entities which were involved in the response. A discussion of their role is included. 1 ref., 3 figs.

45399 **Field validation of sediment bioassays at a marine superfund site: Commencement Bay, Washington.** Becker, D.S. (PTI Environmental Services, Bellevue, WA (USA)); Ginn, T.C.; Bilyard, G.R. pp. 323-328 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Laboratory sediment bioassays and alterations of benthic macroinvertebrate assemblages were evaluated at 43 stations in Commencement Bay, Washington (a chemically contaminated embayment) and at 4 stations in Carr Inlet, Washington (a relatively uncontaminated reference embayment). Three bioassays were evaluated: the amphipod mortality test using Rhepoxynius abronius, the bivalve larvae abnormality test using the oyster Crassostrea gigas and the Microtox test using the bacterium Photobacterium phosphoreum. Alterations of benthic macroinvertebrate assemblages were determined using numerical classification analysis. In general, bioassay responses and alterations of benthic macroinvertebrate assemblages were closely related to chemical contamination, suggesting that most biological effects resulted from chemical toxicity. Although all three bioassays were reasonably successful in predicting the presence or absence of moderately to severely altered benthic assemblages, considerable differences were found in the ability of the tests to specifically identify only the altered assemblages. The Microtox bioassay was the most sensitive of the three tests because it successfully identified the highest percentage of altered assemblages. By contrast, the oyster larvae abnormality bioassay was the most efficient of the three tests because it falsely predicted the lowest percentage of altered assemblages. By using the results of the Microtox and oyster larvae abnormality bioassays in a tiered design, the strengths of both tests were combined to improve the accuracy with which altered assemblages were identified. 23 refs., 4 figs., 2 tabs.

45400 **Selection and evaluation of treatment technologies for the new Bedford Harbor (MA) Superfund Project.** Allen, D.C. (E.C. Jordan-Eastern Region/C-E Environmental Portland, ME (USA)); Ikalainen, A.J. pp. 329-334 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A multi-component approach was used to select and evaluate remedial technologies for the treatment of marine sediments in New Bedford Harbor contaminated with PCBs and metals. A generic list of hazardous waste treatment technologies was identified through trade periodicals and academic/industrial research and development journals; computer data base searches; US EPA guidance documents and funded studies; and direct contacts with technology vendors. Waste-specific and site-specific characteristics coupled with detailed questionnaires sent to vendors provided the screening tools for identifying, from the generic list, treatment technologies potentially applicable to New Bedford Harbor. The treatment technologies retained after the screening process were evaluated in detail using the effectiveness, implementation and cost criteria prescribed by Superfund guidelines for evaluating remedial alternatives. Bench-scale treatment programs were developed and implemented to obtain performance data on the treatment of New Bedford Harbor sediments using technologies which included: solidification, biological treatment, alkali metal dechlorination, solvent extraction, and vitrification. Finally, New Bedford Harbor was selected by the EPA SITE program for a pilot-scale demonstration for treating PCB-contaminated sediments using supercritical fluid extraction. 3 refs., 2 figs., 3 tabs.

45401 **Monitoring program in support of the pilot study of dredging and dredged material disposal methods, New Bedford, Massachusetts Superfund Site.** Phelps, D.K. (Environmental Research Lab., Narragansett, RI (USA)); Hansen, D.J.; Scott, K.J.; Fowler, A.S. pp. 335-337 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The monitoring program for the pilot dredging study at New Bedford Harbor (NBH) superfund site will provide data to evaluate the efficacy of the dredging and confinement operations conducted by the US Army Corps of Engineers (US ACE) as well as to provide protection to marine resources and public health. Responsibility for aquatic monitoring will lie with the US EPA, Environmental Research Laboratory, Narragansett, Rhode Island (ERLN) and for air monitoring, as it relates to human health, with EBASCO. The aquatic monitoring activities in NBH present a unique series of challenges: (1) data must be linked to dredging activities which are episodic and phased with tides, (2) results must meet requirements for real-time applications (3) and useable criteria must be developed to decide whether dredging activities threaten marine resources or human health. ERLN and the US ACE have designed and implemented a monitoring program that includes chemical, biological and hydrographic assessments. Stations are located at key sites within NBH and are sampled temporally to obtain data on pre-operational phases (dredge head and confinement structure evaluations). The situation is complicated because this superfund site is in violation of water quality standards for PCBs and some metals, FDA limits for PCBs in seafood are exceeded, and sediments are toxic. These circumstances required the development of site-specific decision criteria; however, the approach used should be applicable to similar sites and perhaps for general monitoring application as well. A Decision Criteria Document was developed

for use by US EPA Region I on the basis of pre-operational monitoring data sets. The Region has constituted a committee of representatives from the US EPA, US ACE and State of Massachusetts agencies. 3 figs.

45402 A case study: Dredging as a remedial action alternative for New Bedford Harbor, Massachusetts. Averett, D.E. (Army Engineer Waterways Experiment Station, Vicksburg, MI (USA)); Francingues, N.R. Jr. pp. 338-342 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Sediments in the New Bedford Harbor and Acushnet River Estuary have been contaminated with PCBs and heavy metals. The high levels of contamination have resulted in the New Bedford Harbor being placed on the NPL. Efforts are underway to develop and implement remedial actions for protection of the environment under the Superfund Program. Since many of the remedial alternatives being considered involve removal of the contaminated sediment by dredging, the US EPA employed the US Army Corps of Engineers (US ACE), the Nation's dredging expert, to perform an Engineering Feasibility Study (EFS) of Dredging and Disposal Alternatives. US ACE offices participating in the EFS were the Waterways Experiment Station (WES), the New England Division (NED), the Omaha District, and the Civil Works Dredging Division. The EFS technical approach used field data collection activities, literature reviews, laboratory (bench-scale) studies, and analytical and numerical modeling techniques to assess engineering feasibility and develop conceptual alternatives for dredging and dredged material disposal. Technical and engineering issues addressed by the EFS included baseline mapping, geotechnical investigations, hydrodynamics, sediment resuspension and transport, contaminant releases to surface and groundwater, dredged material settling properties, dredging equipment and controls, effluent treatment, solidification/stabilization of dredged material, confined disposal facility design, contained aquatic disposal facility design, and cost estimates for the alternatives evaluated. 3 refs., 3 figs.

45403 New Bedford Harbor project management case study. Ciavattieri, F.J. (Environmental Protection Agency, Boston, MA (USA)); Stockinger, S.L. pp. 343-346 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The New Bedford Harbor Superfund Site, consisting of nearly 18,000 acres of harbor sediment contaminated with PCBs and heavy metals, is a complex project. Seven federal agencies and departments, and seven state agencies, departments and offices have regulatory or review responsibility in the remedial action selection process, or related activities. There are more than a dozen private contractors and institutions and four federal agencies conducting engineering and scientific studies as part of the RI/FS. Fifty major tasks will have been completed prior to the issuance of the ROD. Estimated costs for these tasks will exceed $15 million and 200,000 hours of labor. Management of the organizations and resources employed on this project to accomplish the objectives, on schedule and within budget, requires the use of proven procedures and systems. Effective tracking reporting systems are particularly important in this regard, and must provide the Project Manager with information on potential delays and unanticipated problems on a timely basis so corrective or responsive action can be taken. In addition, it is necessary to have procedures for review of technical work. The US EPA Region Project Manager has overall responsibility for the entire project. Many of the project activities are carried out by the US Army Corps of Engineers (USACE) or Ebasco. The Ebasco Project Manager coordinates activities of those organizations directly under his control; tracks the budget, schedule and progress of all team members involved; coordinates the review and approval of technical reports; and arranges for expertise required for special assignments. This is the first time the EPA has utilized this pilot management approach. 4 figs.

45404 Pilot study of dredging and dredged material disposal methods, New Bedford, Massachusetts Superfund site. Otis, M.J. (Army Corps of Engineers, Waltham, MA (USA)); Averett, D.E. pp. 347 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Bottom sediments in New Bedford Harbor contained such elevated levels of PCBs and heavy metals that New Bedford Harbor had been placed on the NPL. The US EPA requested that the US Army Corps of Engineers evaluate the engineering feasibility of dredging and dredged material disposal alternatives which are being considered as potential remedial actions at the site. This paper describes a pilot study which is being conducted as part of this evaluation. The use of three hydraulic dredges and two disposal techniques will be demonstrated on-site in New Bedford over the summer and fall of 1988 to address the following technical objectives: Determine the efficiency of dredging for removal of PCB contaminated sediment; Evaluate sediment resuspension and contaminant release during construction, dredging and disposal operations; Refine and scale-up laboratory data for design of disposal/treatment processes for contaminated dredged material; Develop and field test procedures for construction of contained aquatic disposal cells under site-specific conditions; Evaluate containment of PCBs in the disposal areas; Establish actual cost data. The results of the study will provide a site-specific technical evaluation of the methods used which will assist the US EPA in their evaluation of remedial alternatives for this site. 4 refs., 6 figs.

45405 Public health and environmental risk assessment for the New Bedford Harbor Superfund site. Ryan, E.A. (E.C. Jordan Co., Wakefield, MA (USA)); Donato, M.J.; Santos, S.L.; Burris, J.A. pp. 353-358 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A complete public health and environmental risk assessment was prepared as part of the RI/FS being conducted for the New Bedford Harbor Superfund site. This site posed some unique risk assessment challenges due to its size and the nature, level, and extent of contamination. The extensive data base generated for the project was used in this risk assessment to provide the most site-specific evaluation possible of the baseline exposures and risks to public health and aquatic organisms. The public health risk assessment divided the site into three areas based on location and level of contamination. The land usage within each area was determined to identify specific locations where exposure to contaminated media was considered likely. The significant routes of exposure were determined to be: (1) direct contact with and ingestion of contaminated sediments; (2) ingestion of contaminated biota; and (3) inhalation of air-borne contaminants. Using the Hydrodynamic-Sediment Transport model, location-specific exposure concentrations were used to estimate human exposure dose levels. Numerous risk scenarios were developed to reflect the varied exposure conditions at this site. The ecological exposure and risk evaluation assessed the impacts of PCB and heavy metal exposure on aquatic organisms. Direct contact exposure to the water column and sediments were evaluated, and a food chain was constructed to demonstrate the potential for biomagnification of contaminants throughout the New Bedford Harbor ecosystem. Studies by the EPA Laboratory and the US Army corps of Engineers provided site-specific toxicity data which were used to evaluate potential risks associated with exposure to contaminated sediments. This paper presents the methodologies used to assess exposure and risk for this Superfund site and describes how this information was used to assist in determining site cleanup objectives. 12 refs., 5 figs.

45406 Application of a mathematical food chain model to evaluate remedial alternatives for PCB-contaminated sediments in New Bedford Harbor, Massachusetts. Connolly, J.P. (HydroQual, Inc., Mahwah, NJ (USA)); St. John, J.P. pp. 359-362 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Since the 1940s, electronics manufacturing firms in the New Bedford, Massachusetts, area have discharged PCB-laden wastewaters to the Acushnet River and New Bedford Harbor, seriously contaminating the waterways and local biota. PCB concentrations are above Food and Drug Administration action levels in many species including the lobster and portions of the area have been closed to commercial and recreational fishing and shellfish harvesting. An investigation has therefore been undertaken to identify practical actions which may be considered to reduce the contamination problem. HydroQual participated in the development of a comprehensive field program to measure contaminants in the water column, sediment, and biota of the New Bedford area which would be suitable for mathematical analysis. A food chain model has been constructed for contaminated top predator species: the American lobster and winter flounder. The food chain below the top predators includes mussels, clams, crabs, plankton and polychaetes. The model is used to track four PCB homologs, total PCB and three heavy metals, copper, cadmium and lead, through the food chains for these species in response to contaminated water columns and sediments. The model was calibrated with field data collected in New Bedford Harbor and Buzzards Bay during 1984 and 1985. After calibration, the model will be used to assess future conditions under no action and with various remedial measures. 14 refs., 4 figs., 2 tabs.

45407 Applying an innovative ground water remedial investigations program in karst terrain. Coia, M.F. (Roy F. Weston, Inc., West Chester, PA (USA)); Scheinfeld, R.A.; Janosik, V. pp. 363-374 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Reeser's Landfill, a former municipal waste disposal site located 5 mi. west of Allentown, Pennsylvania, was investigated for the US EPA under Superfund during 1987-1988. The landfill is situated in an area underlain by complexly folded and faulted lower Ordovician limestones which are mantled by a thick soil overburden (>90 ft.). The landfill was thought to have been the source of heavy metal contaminants detected in a nearby stream and a residential well during an earlier investigation. The Remedial Investigations (RI) program for Reeser's Landfill focused on characterizing the contaminants present in the landfill and describing migration into the karst bedrock groundwater formations in the area. A comprehensive hydrogeologic program was implemented to locate and install monitor wells and to sample and evaluate groundwater quality. The interdependence of multiple geophysical techniques and hydrogeologic activities was investigated. The Reeser's Landfill RI program presented an opportunity to evaluate and contrast the data generated from multiple geophysical, hydrogeologic and computer modeling techniques in an area comprised of complex geologic formations. As part of the initial field activities at the site, a fracture trace analysis was performed; 15 fracture traces were identified in the carbonate rocks surrounding the landfill. A seismic refraction survey and a field reconnaissance were employed to fine tune the exact locations of the fracture traces as sites for the emplacement of monitor wells. Bedrock cores, borehole geophysical logs and downhole television were used to evaluate the nature of the fracturing in five bedrock monitor wells. The wells were ultimately completed in a set of high yielding (20 to 50 gpm) water-filled voids. 6 refs., 11 figs.

45408 Realistic time frames for free hydrocarbon recovery. Testa, S.M. (Engineering Enterprises, Inc., Long Beach, CA (USA)); Paczkowski, M.T. pp. 375-381 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Free-phase hydrocarbon product occurs as perched zones on the capillary fringe beneath numerous petroleum-handling facilities, some of which are considered Superfund sites. Under such site conditions, too much emphasis is placed on the time frame required for remediation by federal, state and local regulators, notably in respect to monitoring the efficiency and effectiveness of the respective remediation program. The time required for remediation within the scope of present day technology is a calculated or educated guess at best. Typically, remediation duration is determined by a number of estimates. These estimates have innate compounding errors. Areas of estimation include physical measurement accuracy, true versus apparent thickness, validity of bail-down testing, extrapolation of free hydrocarbon product thicknesses between monitoring points, contouring of thickness maps, extrapolation of geologic information, planimetering and estimation of porosity, specific yield and retention, all of which are key factors used in ultimately determining the volume of free hydrocarbon product in place. Once an initial estimated volume is determined, pilot testing of a recovery system should commence to determine recovery rates. Factors that will affect recovery rates include the areal distribution and geometry of the hydrocarbon pool, type and number of recovery system(s) selected and the performance or efficiency of these systems with time. The effectiveness of the recovery program is thus best estimated based on barrels of hydrocarbon recovered to date divided by the total volume of barrels that are considered recoverable. Remediation time frames at petroleum hydrocarbon recovery sites can be estimated. However, regulators at all levels need to be aware of the large number of compounding errors associated with these calculations. 18 refs., 6 figs., 2 tabs.

45409 Integrated event/fault tree analysis for risk assessment of groundwater contamination. Riojas, A. (Univ. of Texas, San Antonio (USA)); Shih, C. pp. 382-392 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Public concern over groundwater contamination has focused attention on the management of hazardous materials in the US. Recent developments in the field of risk assessment can provide the engineering profession with the necessary tools for responding to this public concern. This paper discusses the risk assessment methodology needed to systematically analyze alternative courses of action and their probable impact on groundwater resources. The analysis begins with the development of an event tree. A list of all possible event sequences to be considered has been compiled, and a detailed analysis of the consequences of each event is conducted. Stemming from a decision on development over the recharge zone of an aquifer, and leading to the introduction of hazardous materials into the groundwater and contamination of the potable water supply, all events have been sequentially structured with both their positive and negative outcomes. The next step is to develop a comprehensive fault tree from the event tree. In the fault tree analysis, the ultimate consequence of groundwater contamination by hazardous waste is the top event and only negative events are included in the analysis. The events that are responsible for the negative conditions are identified and depicted based on their appropriate functional relationships. The logics relationships accurately described by the fault tree are then translated into algebraic operations allowing the objective determination of risk for any pathway leading from the initial policy decisions to the final consequence of contaminated groundwater. Comparison of risk associated with pathways originating from alternative managerial courses of actions provides a basis for decision or policy making. 10 refs., 8 figs., 9 tabs.

45410 Organic geochemistry related to subsurface contaminant transport. Olsen, R.L. (Camp Dresser and McKee Inc., Denver, CO (USA)); Chappell, R. pp. 393-394 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The rate of migration and the concentration of hazardous chemicals in ground water is a major factor in determining potential extent of migration, in performing risk assessment and in designing remedial actions. To assess the rate of migration and concentration of chemicals in ground water requires a thorough understanding of the geochemical behavior of the hazardous chemicals in soil-water systems. Organic chemicals can undergo a variety of reactions in the subsurface including hydrolysis, oxidation/reduction, volatilization, adsorption, and biodegradation. The importance of each of

these processes in effecting the fate and transport of chemicals depends upon the site conditions and the specific chemical compounds of concern. Generally, adsorption and biodegradation are the major reactions effecting chemical transport in ground water. Adsorption can be evaluated and predicted using eight general methods. Several of these methods require only minimal site data that can be easily obtained. As many of the methods as possible should be used depending on the data available and the purposes of the prediction. For example, laboratory studies may be necessary when a quantitative prediction of desorption is needed to design a treatment plant in terms of concentration and design life. In all cases, the prediction should be compared to actual site data. Methods to predict biodegradation are not currently well developed. Qualitative evaluations can be made; however, laboratory and field studies are necessary to make definitive evaluations. Currently a variety of chemical (solute) transport models are available to predict organic chemical transport in ground water aquifers. Typically, these models include adsorption (by including a distribution coefficient) and degradation (by including a first order decay constant). 1 tab.

45411 **Bioremediation of hazardous waste sites in the USA: Case histories.** Ross, D. (Ecova Corp., Redmond, WA (USA)); Maziarz, T.P.; Bourquin, A.W. pp. 395-397 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Remediation of hazardous waste sites can be accomplished best by combining biological, chemical and physical treatment processes with site management and engineering expertise to develop site-specific remediation systems. This paper presents three case histories which demonstrate that microbiological processes can be used as the keystone technology to develop effective remediation systems for hazardous waste sites. 3 figs., 5 tabs.

45412 **Treatment of heavy metal liquid sludge waste with lime.** DuPont, A. (Gator Environmental Services, Inc., Lorton, VA (USA)). pp. 398-402 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Lime is well known for this growing use in the treatment of hazardous waste containing heavy metals. This paper will provide a brief summary of the reasons why the EPA recommends lime and how to use lime and pozzolans for the treatment of hazardous waste. The current concern of most consultants, engineers, and TSD facilities is why should lime be used instead of other additives that appear less costly? This paper will discuss the economics of using lime versus cement kiln dust as a precipitating agent. 15 refs., 2 figs., 3 tabs.

45413 **Methodology for the laboratory investigation of the stabilization/solidification of petroleum sludges.** Evans, J.C. (Bucknell Univ., Lewisburg, PA (USA)); LaGrega, M.D.; Pancoski, S.E.; Raymond, A. pp. 403-408 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Petroleum refineries have produced large quantities of waste products in the form of hydrocarbon sludges. As a result of one specific process utilized in the past to produce highly refined lubricating oils, the resulting sludge is acidic in nature. Historically, these acidic oil sludges were disposed of in open pits and a number of sites have very large quantities of untreated sludges. Present environmental awareness dictates the need to develop a cost-effective method to prevent the migration of these materials in the environment. This paper describes a laboratory investigation of physical-chemical stabilization/solidification methods. In particular, emphasis is placed on describing the testing methodology developed to evaluate stabilization methods which show promise in effectively stabilizing and solidifying the organic (hydrocarbon) constituents of these acidic oil sludges. Results of these laboratory studies will be used to select one or more stabilization methods for full-scale field studies in the final year of this three year research effort. 6 refs., 2 figs., 5 tabs.

45414 **Remediation of chrome leachate field.** Fullerton, T.H. (Earth Resources Corp., Orlando, FL (USA)); Browning, S. pp. 409-412 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In March of 1988, Earth Resources Corporation began a project to excavate chromium- and VOC-contaminated soil at an inactive industrial facility in southeast Florida. Site investigations revealed the presence in the soil of total chromium levels in excess of 8,000 ppm; also present were methylene chloride, ethyl benzene, and benzene. Prior plant operations had discharged waste through a treatment system into an on-site leach field. The impacted area corresponded with the leach bed. The leach field was located in a long, narrow, grass area (115 ft. x 20 ft.) situated between a building and an active road. Combined with the depth of excavation (minimum of 8 ft.) and the inherent instability of Florida sands, these restraints severely hindered excavation. Excavation stabilization was a primary concern. The close proximity of the building and road made both sloping or sheet metal shoring impractical. A hydraulically injected concrete grout barrier was installed around the area to be excavated. This system offered soil stability without the disturbance found with steel sheet piling or the room required for side wall sloping. A second hindrance to excavation was the presence of a shallow water table and a transmissive aquifer. Hydrogeologic calculations indicated that site dewatering would not be feasible because of the volume of water requiring containment and treatment. Though a water treatment system was installed on-site, it was not designed to handle the expected volume of water. Excavation was performed without site dewatering. Dry soil was directly loaded into transport vehicles while wet soils were allowed to drain in the hot zone without significant time delay or additional soil handling. Soils passed the paint filter test after draining and presented no problems during transport or disposal. Decontamination water and groundwater retrieved from the open excavation were treated on-site. 2 figs.

45415 **Treatability tests for thermal treatment and chromium recovery from tannery sludge.** Sczurko, J.J. (C-E Environmental/E.C. Jordan, Portland, ME (USA)); George, L.C.; Paulson, S.E.; Meier, M.P. pp. 413-418 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Bench-scale pyrolysis and incineration tests were performed on sludge from the Saco Tannery Waste Pits Superfund Site to assess the waste's nature when subjected to thermal treatment. Chemical analysis indicates the raw sludge contains chromium concentrations in excess of 10,000 mg/kg and a variety of organic constituents including dichlorobenzenes, xylenes, and phenols. The diverse mix of contaminants and significant levels of chromium in the 100,000 cubic yards of sludge at the site supported treatability tests to assess the feasibility of chromium recovery. An extensive treatability study program, conducted by the US Bureau of Mines, evaluated the technical aspects of applying metallurgical processes for sludge treatment and chromium recovery. Thermal treatment residues were subjected to leaching tests to analyze leachability and to help conceptualize a chromium recovery process. Waste characterization studies were also performed to provide information regarding waste structure and chromium phases. The research program is particularly important because of SARA's emphasis on utilizing alternative treatment technologies and resource recovery methods to remediate hazardous waste sites. 6 refs., 5 figs., 9 tabs.

45416 **Decontamination of structures and debris at superfund sites.** Taylor, M.L. (PEI Associates, Inc., Cincinnati, OH (USA)); Dosani, M.A.; Wentz, J.A.; Sukol, R.B.; Kling, T.L.; Greber, J.S.; Barkley, N.P. pp. 419-423 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A large number of sites in the US are contaminated with hazardous chemical residues. Many of these sites include structures (e.g. buildings, manufacturing facilities) which are contaminated with hazardous organic chemicals such as PCBs. In addition, many hazardous waste sites are littered with debris (e.g., scrap metal, equipment or furniture) which is also contaminated. Currently, the common practice is to raze the structures and dispose of contaminated structural components and debris in a RCRA Subtitle C hazardous waste landfill or incinerator which is very costly. Hence, more cost-effective yet environmentally-compatible methods for dealing with contaminated structures and debris are clearly needed. In this paper, the authors present the results of evaluating the efficacy of two technologies which have previously shown promise for removing PCBs in or on poured concrete floors. These two technologies are: (1) in situ degradation of PCBs entailing application of an alkali metal/polyethylene glycolate mixture directly to the concrete surface, and (2) a shotblasting technique which entails use of steel shot to cut away concrete surfaces. In order to evaluate these PCB removal techniques, concentrations of PCBs in the top 0.5-in. of the contaminated concrete floor were determined before and after treatment by analyzing cores obtained from selected locations on the concrete floor. An innovative process for decontaminating debris was also designed and evaluated. The process utilizes a hydromechanical cleaning system and a custom-designed system which continuously cleans and recycles the solution. Bench-scale experiments were performed to determine the optimal solution for cleaning PCB-contaminated, corroded iron components. They describe a 300-gallon, pilot-scale module which is being assembled and will be field-tested at a Superfund site. 1 ref., 4 figs., 4 tabs.

45417 Successful on-site treatment of phenols, cresols in soil. Mandel, R.M. (Environmental Protection Agency, San Francisco, CA (USA)); Allen, H.L.; Evangelista, R.A.; Worobel, R. pp. 424-428 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

With the enactment of SARA (Section 121) in 1986, the US EPA was mandated to select remedial actions which permanently treat and significantly reduce the volume, toxicity, or mobility of the hazardous substances over those remedial actions not involving such treatment. SARA further states that...off-site treatment and disposal...without such treatment should be the least favored alternative remedial action where practical treatment technologies are available. To meet this new challenge, EPA selected multiple on-site treatment techniques to clean up phenol and cresol contaminated soils at the Poly-Carb Site in Wells, Nevada. The selection of the appropriate technologies was assisted by treatability studies arranged by EPA's Environmental Response Team from Edison, New Jersey. Based on these studies, soil washing, passive evaporation, and biological degradation were selected as the most appropriate treatment process. The treatment system design required careful planning so that no single treatment technique would hamper another. The design of the lined soil washing treatment area ensured that passive evaporation and biodegradation treatment techniques would be enhanced. Due to the site's remote location in an arid area, on-site wells were installed to serve multiple purposes: contaminant monitoring, water supply for the soil washing, and contaminant extraction and treatment. Construction of the treatment system took 18 days. A total of 1,500 yd^3 of soil containing approximately 1,000 ppm phenol were excavated, aerated, and loaded in a double high density polyethylene-lined trench. Sprinklers generated 10 gpm leachate which was collected in a sump and extracted with granular activated carbon. After 2 mo. of washing, contaminant concentrations decreased more than 99%. A cost analysis indicates that treatment costs will be $266/$yd^3$, - a cost which is very competitive. 16 refs., 6 figs., 1 tab.

45418 Analysis of contaminated soil treatment effectiveness. Offutt, C.K. (Environmental Protection Agency, Washington, DC (USA)); O'Neill Knapp, J.; Cord-Duthinh, E.; Bissex, D.A.; Oravetz, A.W. Jr.; Lacy, G.D.; Kenney, P.J.; Green, E.L.; Bhinge, D. pp. 429-434 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

To comply with SARA of 1986, the US EPA began to reevaluate past disposal practices for contaminated soils from Superfund sites. SARA required that EPA give preference to permanent remedies for these and all Superfund wastes. In addition, the 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA required EPA to establish land disposal restrictions (LDRs) prescribing treatment standards for contaminated soil from Superfund sites. The EPA Office of Emergency and Remedial Response (OERR) contracted CDM Federal Programs Corporation to assist the Agency in fulfilling these obligations. An extensive soil treatment data collection effort was conducted throughout 1987 and 1988. The results from several hundred previously conducted studies were collected and reviewed. All applicable soil treatment information was carefully extracted and loaded into a series of relational data bases developed specifically for this application. The quantitative data were subjected to a limited mathematical analysis to determine the effectiveness of six categories of treatment technologies on eleven contaminant treatability groups. The qualitative information was valuable in documenting the unique characteristics of various contaminant-soil matrices and their treatability. The results of both the quantitative and qualitative analyses have been used to prepare Superfund program guidance. This paper summarizes the results of this study and the guidance developed for the treatment of contaminated soils. Refer to the principal report developed as part of this study for further detailed discussions of the available soil treatment results. 1 ref., 1 tab.

45419 Selecting cleanup criteria for contaminated surface soils in environmentally sensitive areas. Cullinane, M.J. Jr. (USAE Waterways Experiment Station, Vicksburg, MI (USA)); Lee, C.R.; O'Neil, L.J.; Robertson, J.M. pp. 435-439 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Selecting appropriate cleanup criteria for contaminated soils is one of the most complex tasks associated with the RI/FS study process. The difficulty of this task is increased when the site under evaluation is inhabited by endangered species or provides environmentally sensitive wildlife habitat. Fourteen potential soil cleanup criteria, including both qualitative and quantitative criteria, are reviewed. Potential criteria are divided into four categories: contaminant content of soil, direct contact, indirect contact, and habitat quality. An evaluation procedure is resented that establishes a framework for developing appropriate site-specific soil cleanup criteria. 7 refs., 1 fig., 3 tabs.

45420 Organically modified clays for stabilization of organic hazardous wastes. Alther, G.R. (Bentec, Inc., Ferndale, MI (USA)); Evans, J.C.; Pancoski, S.E. pp. 440-445 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141–: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Remediation of Superfund sites has created the need to stabilize/solidify organic hazardous wastes. The stabilization/solidification process must first result in a material that is stable (typically, as evaluated quantitatively in an unconfined compression test). More importantly, the solidified material must minimize the rate of leaching of hazardous constituents from the stabilized matrix. Conventional stabilization agents, such as cement or fly ash, are successful in stabilizing metal-bearing wastes but are less successful with organic wastes. Organically modified clays (organophilic clays) may be employed to adsorb organic waste constituents, thus enhancing the stabilization of organic hazardous waste. Organically modified clays are prepared by replacing the exchangeable inorganic metallic cations present in the natural clay to satisfy the net negative charge on the silicate layers within the clay mineralogical structure. Certain organic cations used in this replacement process then have the capability to adsorb other organic compounds. Thus, an organically modified clay can adsorb a wide range of organic waste constituents which are not otherwise adsorbed by unmodified clays or conventional stabilization agents.

When mixed with additional stabilization agents (such as cement, cement kiln dust, or fly ash), organic wastes may be solidified into a stable mass with low leaching potential. Data are presented to show the adsorptive capabilities of several organically modified clays along with unmodified clays. Data on the use of organically modified clays in organic sludge stabilization are also presented and described. The importance of these findings cannot be overstated as stabilization technology for the remediation of hazardous waste sites begins to take preference over the excavate and remove option. 16 refs., 4 figs., 1 tab.

45421 In situ bioremediation of methylene chloride-contaminated groundwater following physical treatment. Jerger, D.E. (O.H. Materials Corp., Findlay, OH (USA)); Flathman, P.E. pp. 446-450 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Physical and biological techniques were used successfully to treat methylene chloride-contaminated groundwater following an underground pipeline rupture. Interceptor trenches were constructed initially to contain free-standing product which was staged in vessels for later on-site treatment. Monitoring wells were used to identify the contaminant plume, and pumping techniques were employed to contain the methylene chloride. Following 2 mo. of field operation pumping and air stripping techniques provided an estimated 97% reduction of methylene chloride in the groundwater. The feasibility of further site matrix remediation by in situ bioremediation techniques was examined. Laboratory screening studies with representative groundwater samples showed that acclimated bacterial populations at the site could degrade methylene chloride at the average groundwater concentrations of 100 mg./l. within 25 hr. An underground recovery and treatment system was placed into operation on-site. A modified activated sludge system provided efficient surface treatment and permitted wasting of adapted bacteria to the soil/groundwater environment. Methylene chloride concentrations were reduced from 192 to 6 mg./l. in the groundwater environment. With an initial concentration of 192 mg./l., a half-life of 8 days was observed for biological removal of methylene chloride from the groundwater. Residual methylene chloride contamination in the soil and groundwater was treated using a fixed-film reactor and in situ remediation during the second treatment phase. Following approximately 240 days of treatment, methylene chloride concentrations in the monitoring wells ranged from less than 1.0 to 3 μg./l. representing up to a 5-order of magnitude reduction in groundwater concentrations. 7 refs., 8 figs., 1 tab.

45422 Anaerobic biodegradation of benzene, toluene and xylenes. Bowlen, G.F. (Rutgers, The State Univ. of New Jersey, Piscataway (USA)); Kosson, D.S. pp. 451-454 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Benzene, toluene and xylenes (BTX) were degraded by a mixed microbial population from an anaerobic sewage sludge digester. The BTX components were examined separately including each of the xylene isomers. Denitrifying conditions were maintained throughout the experiment, and the utilization of nitrate as an electron acceptor was observed. Benzene did not degrade significantly, while toluene and the three xylene isomers showed transformations of 65-80% over a 1-wk. period. The effects of contaminant concentration, nitrate concentration and co-substrate concentration are discussed. 13 refs., 2 figs., 3 tabs.

45423 Microbubble applications for hazardous waste treatment. Michelsen, D.L. (Virginia Institute of Technology, Blacksburg (USA)); Foss, A.; Smith, J.W. pp. 455-461 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The characterization, determination of properties, and design of an efficient means of producing commercial quantities of a 50 to 70% dispersion of 50 + 40 micron bubbles has been achieved. These microbubbles have displayed an ability, upon injection, to be retained in saturated soil matrices and sediments as well as deeper saturated subsoils. Testing in a vertical slice test cell has demonstrated the ability of microbubbles (also directly injected air) to provide dissolved oxygen to anaerobic groundwater flowing through a treatment zone. Utilization of oxygen, defined as per cent of air injected dissolved in the flowing water, has been in the range of 1 2 to 25 % for intermittent microbubble injections compared to 0.3 to 0.8% for continuous air injections. Aquarium tests have provided microbubble retentions of 75 to 100%, using horizontal injector sand soil layering-techniques to be tested in the vertical slice. Microbubble flotation and floc-flotation techniques have been demonstrated previously in the laboratory for removal of submicron-sized clays, algae and phosphate slimes. Now, pilot testing using a portable microbubble generator and flotation cell has looked encouraging for removal of micron-sized particulates. Applications of these techniques for treatment of contaminated leachates and contaminant clay/selective adsorbents are planned. Finally, microbubble generation capacity has been achieved to allow in situ biodegradation feasibility testing of slurried, contaminated soils, sediment ponds or closed vessels. 24 refs., 7 figs.

45424 Installation of a deep drainage trench by the biopolymer slurry drain technique. Day, S.R. (Geo-Con, Inc., Pittsburgh, PA (USA)); Hanford, R.W. pp. 462-466 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Deep drainage or interceptor trenches can be used to collect and contain groundwater-born contaminates. In the past, such trenches have seen limited applications on deep waste containment projects due to the problems and costs associated with trench bracing, dewatering and working in a confined, hazardous space. This paper examines a newly developed technique which permits the installation of deep interceptor trenches by a version of the slurry trench technique which uses a biodegradable agent instead of bentonite to create a continuous aggregate-filled trench. Experience during and after the project showed the deep drainage trench to be an effective, safe and economical means of installing a drain for controlling contaminated groundwater. 9 figs.

45425 Natural mechanisms in soil to mitigate cyanide releases. Chatwin, T.D. (Resource Recovery and Conservation Consultants, Salt Lake City, UT (USA)); Zhang, J.; Gridley, G.M. pp. 467-473 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Soils in the unsaturated (vadose) zone have exhibited natural cyanide removal capacity for waste streams typical of mineral processing, steel and aluminum industries. This study revealed a number of physico-chemical mechanisms that attenuate/degrade cyanide in soils. These mechanisms include: (1) volatilization; (2) cyanide adsorption on soil surfaces; (3) catalytic oxidation of cyanide to cyanate; (4) chelation to less toxic cyanide species; and (5) biodegradation. Twenty eight soils were tested in columns and stirred reactor vessels. Data suggest that given appropriate environmental conditions in the vadose zone (i.e., mineralogy, depth-to-groundwater, soil moisture, conductivity and permeability, etc.), natural attenuation/degradation appears to effectively remove cyanide in the vadose zone. In addition, promising results with bioaugmented bacteria treating cyanide in situ presently are being assessed. Applicability of natural in situ cyanide attenuation/degradation for effluents such as those which occur in mining, mineral processing, steel and aluminum industries are discussed. 21 refs., 7 figs., 2 tabs.

45426 Development of remedial design for KPEG chemical treatment of PCB contaminated soil at Wide Beach, New York Superfund site. Cleary, J.G. (Ebasco Services Inc., Lyndhurst, NJ (USA)); Granger, T. pp. 474-478 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A Record of Decision (ROD) was signed by the US EPA in August, 1985 for the Wide Beach Superfund Site in New York State. The site is a 55-acre residential community consisting of 60 homes, located in Erie County. Soil in the roadways, adjacent drainage ditches, driveways and front yards is contaminated with PCBs at concentrations as high as 1000 mg/kg. The source of PCB was oil spread on the dirt roads for dust control. The ROD specified excavation of the contaminated soil in the roadways, drainage ditches, driveways, yards, and wetlands and on-site chemical treatment of soil using the innovative KPEG treatment process. The KPEG process consists of mixing potassium hydroxide, polyethylene glycols, and other cosolvents and catalysts with the soil in a heated slurry process which dechlorinates the PCBs to non-toxic end-products. Ebasco Services, Incorporated under the REM III contract, was retained by US EPA Region II to prepare the remedial design for the overall site remediation. The scope of work for the remedial design also included pilot-scale treatability studies for chemical treatment of soil using the KPEG process. A technical scope of work was developed to perform bench and pilot-scale studies to develop the process design, cost estimate, and specifications to treat approximately 40,000 yds^3 of PCB-contaminated soil. The objective was to prepare the technical bid documents, engineering drawings and specifications for the design/fabrication of a mobile KPEG treatment system to treat soil at the site. Bench-scale treatability studies on several soil samples showed PCB reduction from 500 to 700 to less than 10 ppm PCBs. An on-site pilot study was performed using the KPEG slurry process in a 35-gal pilot-scale reactor. The pilot test program was designed to develop process design information including batch treatment cycle times and reagent recovery and treatment costs. 1 ref., 6 figs., 2 tabs.

45427 Multifunctional container-piles for the safe excavation, treatment, transport and/or storage of hot spots and dioxin-containing dumps. Mischgofsky, F.H. (Delft Geotechnics (Netherlands)); van der Meer, J.P.; van de Velde, J.L.; Hannink, G.; de Walle, F.P.; Keulen, R.W. pp. 479-483 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

It is generally assumed that dioxin-containing waste cannot be excavated from a dump without posing serious health risks for excavation personnel and neighboring residents a.o. because of toxic dust and vapor emissions. In a pre-feasibility study for the safe excavation of the 900 kg. 2,3,7,8-TCDD containing Hyde Park Landfill in Niagara Falls, New York, Delft Geotechnics developed an innovative method called the Container-Pile option (patent pending) derived from state-of-the-art civil-engineering and off-shore technology, which greatly reduces the hazardous dust problems and safety risks during excavation, transport and storage of the hazardous waste and contaminated soil. 10 refs., 7 figs.

45428 Soil treatment technology selection at Post-SARA Sites: Comparative analysis of five case studies. Hokanson, S. (Earth Technology Corp., Alexandria, VA (USA)); Hazelwood, D.; DiLoreto, J. pp. 484-489 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

As a result of new requirements set forth in SARA, feasibility studies must include detailed analyses of treatment alternatives. Where feasible, treatment alternatives for soil and groundwater must be selected over containment and removal alternatives. This paper presents results from a comparative analysis of five feasibility studies. The five case studies represent the wide variety of soil treatment alternatives currently being considered and selected at post-SARA sites. Performance of post-screening field activities and the approaches and technical arguments used to develop soil cleanup levels and evaluate treatment alternatives were compared among the five case studies. When developing soil cleanup levels and evaluating treatment alternatives, Superfund contractors generally are obtaining critical information from the literature, rather than from bench-scale studies (i.e., leach tests and treatability studies). At best, the lack of site-specific data leads to large uncertainties in performance and costs of soil and groundwater treatment alternatives. At worst, it may lead to selection of inappropriate solutions to the problem. Unfortunately, the full impact of insufficient site data will not be known until these sites enter into the design and implementation stages of Superfund cleanup. In order to institute more consistency and technical accuracy into the remedy selection process, future RI/FS guidance needs to address the following areas: (1) deriving soil cleanup levels, (2) evaluating costs, and (3) conducting treatability studies. 7 refs., 2 figs., 7 tabs.

45429 Bioremediation of soils contaminated with a mixture of hydrocarbon wastes: A case study. Baker, K.H. (Biotex, Inc., Newark, DE (USA)); Herson, D.S.; Buniski, D.A. pp. 490-494 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Among the new technologies for the in situ remediation of hazardous waste contaminated soils is bioremediation. This technology involves the use of microorganisms to degrade hazardous wastes in the environment. Biodetox, Inc., has recently applied this technology to a variety of remediation projects including gasoline and other fuel spills, naphthalene contaminated soils, and soils contaminated with a mixture of industrial by-products at a manufacturing site. The authors report here on the procedures used to design and implement bioremediation for soils contaminated with a variety of hydrocarbons at a refrigerator/cooler manufacturing facility. Preliminary chemical and engineering surveys of the plant indicated a high degree of within site heterogeneity both in terms of the type and amount of contaminant present (aromatic compounds such as toluene, benzene, and ethyl benzene, and chlorinated hydrocarbons such as TCE, chloroform and methylene chloride were the major compounds of interest) and in terms of the soil characteristics ranging from silty loam to highly clayey. Therefore, the plant was divided into remediation sites. Feasibility studies were carried out independently for each remediation site, and treatment plans were developed and implemented independently for each site. The feasibility of enhanced bioremediation for each site was determined using a two level approach. Enrichment cultures were used to demonstrate the presence of microbes capable of metabolizing individual pollutants at the sites. Measurements of community microbial respiration were used concurrently to determine appropriate modifications of the abiotic environment which would result in enhanced microbial activity. Finally, substrate disappearance in spiked microcosms was used to confirm that biodegradation was occurring. Land farming treatment regimes and monitoring protocols were developed for each site. 17 refs., 6 figs., 3 tabs.

45430 Degradation of a toxaphene-contaminated soil matrix under anaerobic conditions. Aurelius, M.W. (Radian Corp., Austin, TX (USA)); Wallace, R.C. pp. 495-497 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Operations at a commercial crop-dusting airport in Phoenix, Arizona resulted in the contamination of 20 ac. of land with toxaphene, a pesticide mixture of 177 different chlorinated camphene compounds. The low mobility and slow aerobic degradation rate of this substance causes it to persist in soils. Following an evaluation of remedial alternatives, field and laboratory experiments were conducted to further evaluate the feasibility of on-site anaerobic degradation of toxaphene. Microbial activity was stimulated by mixing sewage sludge and chemical nitrogen into the soil to adjust the carbon:nitrogen ratio to provide an appropriate substrate for cometabolism of the toxaphene. The field experiment resulted in a 60% reduction in the concentration of toxaphene in 60 days. These results influenced the design and construction of a full-scale, lined treatment pit capable of holding 6,000 yd^3 of the most highly contaminated soil. 2 figs., 3 tabs.

45431 Field test of the radio frequency in situ soil decontamination process. Dev, H. (IIT Research Institute, Chicago, IL (USA)); Sresty, G.C.; Bridges, J.E.; Downey, D. pp. 498-502 of Superfund '88. Hazardous Materials Control Research Institute, Silver

Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A field test was performed to prove the feasibility of the RF in situ soil decontamination process. The test site was located in an old fire training area which had been used to conduct fire training drills in simulated aircraft fires. It is estimated that approximately 50,000 gal. of unburnt jet fuel soaked in the sandy soil of the fire training area. The feasibility of the RF in situ decontamination process was demonstrated by heating a block of soil of dimensions 6 ft x 12 ft x 7 ft to a temperature range of 150°-160°C. Analysis of numerous pre- and post-test soil samples has indicated that on the average 99% of the volatile aromatics and aliphatics had been removed from the 500 cu ft heated volume. On the average, 94% of semi-volatile aliphatics and 99% of the aromatics were also removed. Migration of contaminants into and out of the heated zone was assessed by injecting a tracer into the soil and by sampling soil in zones immediately outside the perimeter of the heated volume. Halon tracer, injected 4 ft outside the heated volume at a depth of 6 ft, was detected in the raw gases being collected from the heated zone. This indicates that soil gases and liquids were moving into the heated zone from outside, A contaminant reduction of 70-76% was observed in the immediate area outside the heated zone. These results demonstrate that there was no net migration of contaminant from the heated area to the surrounding soil. The results of this study warrant optimization and full-scale demonstration of the technology so that it can be used on a commercial basis for the remediation of sites containing jet fuel, gasoline, and other similar contaminants. 7 refs., 8 figs., 1 tab.

45432 Statistical methods for assessing the attainment of cleanup standards in soil and groundwater. Rogers, J. (Westat, Rockville, MD (USA)). pp. 503 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This seminar provides a brief introduction into the use of probability sampling and statistical hypothesis tests to determine if the remedial cleanup at a Superfund site has attained the desired cleanup goals. The presentation is based on guidance documents which Westat is currently preparing for EPA. The seminar is directed to those with little statistical background and should be most useful to those who must manage the cleanup effort. Topics covered include: distribution of the data, sample design, hypothesis tests, power curves, and cost effective sample size.

45433 In situ treatment of PCB-contaminated soil. Stinson, M.K. (Environmental Protection Agency, Edison, NJ (USA)); Sawyer, S. pp. 504-507 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In response to SARA, the U.S. EPA established the Superfund Innovative Technology Evaluation (SITE) program to accelerate the development, demonstration and use of innovative technologies as alternatives to land containment systems for hazardous wastes. A new technology, which is claimed to immobilize organics, was demonstrated in April 1988. It is an in situ stabilization/solidification process for the treatment of contaminated soils which utilized a proprietary additive of International Waste Technologies (IWT) and in situ injection equipment of Geo-Con, Inc. The process consists of preparing the feed slurry by mixing dry additive with water. The slurry then is pumped to the injection auger where it exits from the auger bottom and is mixed with the soil on the downstroke and further mixed on the upstroke. A parallel water feed is injected through the drill auger to obtain the correct soil-additive consistency. Both before and after the remediation, samples were taken from multiple locations and depths. Analyses were performed to measure PCB mobility and solidified soil integrity. The program for the evaluation of this technology is described in this paper. 6 figs.

45434 Site program demonstration of hazcon technology. De Percin, P.R. (Environmental Protection Agency, Cincinnati, OH (USA)); Sawyer, S. pp. 508-512 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

SARA established the Superfund Innovative Technology Evaluation (SITE) Program to accelerate the development, demonstration and use of innovative technologies as alternatives to land containment systems for hazardous wastes. An innovative technology that was demonstrated in October 1987 under the SITE Program is the HAZCON Solidification process. This process mixes hazardous soils, cement, water and a proprietary additive called Chloranan. The treatment immobilizes the contaminants by binding them into a concrete-like mass. The Douglassville, Pennsylvania Superfund site was selected for the Demonstration Test. This location is a former oil reprocessing plant and contains high levels of oil and grease along with volatile and semivolatile organics, PCBs and heavy metals. Feedstocks from six plant areas with varying contaminant levels were tested. The process consisted of excavating the feedstocks, screening out oversized material and feeding the soil to the HAZCON Mobile Field Blending Unit. At the unit, cement, water and Chloranan were added and blended. The product slurry was fed into wooden molds which, after hardening, were buried at their respective excavation sites. Physical and chemical analyses were performed on the untreated and treated soil samples. 6 figs., 6 tabs.

45435 SITE demonstration of the Shirco infrared incinerator. Wall, H.O. (Environmental Protection Agency, Cincinnati, OH (USA)); Rosenthal, S. pp. 513-515 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A Shirco Infrared System used for removal of an oil refining waste containing organics and PCBs was evaluated. The evaluation included a determination of toxics in the material being incinerated as well as the effluent streams such as ash, air emissions and scrubber water blowdown. These streams were analyzed for heavy metals, organics, dioxins, furans, NO, and inorganic acids. Leaching tests were performed on the ash. Results indicated that PCB was reduced from 3 to 6 ppm in the feed material to less than 1 ppm in the ash. The lead concentration in the ash remained about the same as in the feed. Lead was leachable in the ash based on EP toxicity test. 4 tabs.

45436 Status of the Superfund Innovative Technology Evaluation (SITE) Program. Hill, R.D. (Environmental Protection Agency, Cincinnati, OH (USA)). pp. 516-520 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In 1986, the US EPA's Offices of Solid Waste and Emergency Response, and Research and Development established a technology research, demonstration and evaluation program to promote the development and use of innovative technologies. Called the Superfund Innovative Technology Evaluation (SITE), this program will help provide the treatment technologies necessary to implement new cleanup standards that require a greater reliance on permanent remedies at Superfund sites. The SITE program, directed by the Risk Reduction Engineering Laboratory, has been focused along three lines: (1) a full-scale demonstration program; (2) an emerging technologies development program; and (3) innovative technologies development within the US EPA. The Demonstration Program (DP) represents a unique partnership between the US EPA and technology developers. Although most projects involve no funding for developers, a mutually beneficial relationship is established for both parties. Developers are responsible for mobilizing their units and operating them at selected sites. These may be Superfund sites, developer's facilities, US EPA laboratories or private sites. The US EPA is responsible for sampling, analysis and evaluation of test results. The developers are provided extensive data that validate their capabilities while the US EPA is able to assess the performance, reliability and cost of technologies. This information will be used directly by regional and state personnel

responsible for the selection of remedies and responses at Superfund sites. As of August 1988, 29 technologies are in the DP. The Emerging Technologies Program (ETP) was initiated in 1987 and fosters the further development of technologies that are not yet ready for full-scale demonstration. The goal is to ensure that a steady stream of more permanent, cost effective technologies will be ready to be demonstrated in the field. 3 refs., 3 tabs.

45437 Innovative technologies: Response to public concerns. Galer, L.D. (Environmental Protection Agency, Washington, DC (USA)); Enneking, P.A. pp. 521-523 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In 1986 the US EPA created the SITE in order to demonstrate and evaluate innovative methods of treating wastes found at Superfund sites. Congress required that the EPA conduct a public review and comment period prior to selecting a Superfund site for a technology demonstration under this program. To assist the EPA staff in responding to the public's questions and concerns about technologies and planned demonstration projects, the EPA has prepared a list of typical questions that citizens might ask regarding the innovative technologies to be evaluated, and recommended responses to the questions written in layman's terms. The questions are both general and technology specific, and apply to all types of technologies. This paper discusses the typical questions one can expect concerning treatment technologies, and presents an illustration of a few of the anticipated questions and responses for one technology, a biological treatment process soon to be demonstrated in the SITE program. Although each project is different, the examples can serve as a basis for responding to public concerns about the use in their community of innovative or proven treatment technologies. 2 tabs.

45438 Principles and practices of health communication: A public health agency's perspective. Abraham, J.E. (Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA)); Lichtveld, M. pp. 524-527 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The role of The Agency for Toxic Substances and Disease Registry (ATSDR), part of the Public Health Service is discussed. At ATSDR, health communication is an essential part of a herarchial spectrum of public health involvement and of each facet of ATSDR's Health Assessment Process. The major Agency program areas are Emergency Response, Health Assessments, Health Effect Studies and Exposure and Disease Registries. ATSDR is currently establishing and maintaining a national registry of persons exposed to hazardous substances.

45439 Health assessment conducted under the authority of superfund. Mueller, S.L. (Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA)); Allred, P.M. pp. 528-531 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

CERCLA, as amended, authorizes the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct Health Assessments for all sites on the NPL. A Health Assessment includes preliminary assessments of the potential risk that individual sites and facilities pose to human health. In completing the Health Assessments, ATSDR personnel evaluate the nature and extent of contamination, the existence of potential pathways of human exposure, the size and potential susceptibility of potentially exposed populations and the estimated and observed levels of exposure. The purpose of the assessment is to help public health and regulatory officials determine if actions should be taken to reduce human exposure to hazardous substances and to recommend whether additional information on human exposure and associated risks is needed. CERCLA and RCRA, as amended, also authorize ATSDR personnel to conduct Health Assessments for releases or facilities where persons or licensed physicians provide information that individuals have been exposed to a hazardous substance. The purpose of such Petitioned Health Assessments is the same as for a Health Assessment. However, several differences exist. A Petitioned Health NPL that is regulated under RCRA or some other environmental authority. With a Petitioned Health Assessment, ATSDR personnel attempt to involve the petitioner and the affected community during the assessment process. The comments and information provided by the public are considered during the development of the Health Assessment document. Public involvement increases the complexity of the process. However, such involvement better meets the needs of the affected citizens and makes the citizens feel that they have been involved in dealing with the problems associated with hazardous waste sites or releases. 4 refs.

45440 Impact of remedial investigation data and information on performing health assessments. Rodenbeck, S.E. (Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA)); Ulirsch, G.V. pp. 532-536 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A Health Assessment developed by the Agency for Toxic Substances and Disease Registry (ATSDR) evaluates the current or future impact on public health as a result of any release of hazardous substances into the environment from a site listed, or proposed to be listed, on the National Priorities List. The information and data obtained during the site remedial investigation are used to develop the Health Assessment. Often a complete data package is not available for a Superfund site, and ATSDR must obtain the information from other sources. Generally, if the information requirements of ATSDR were understood, all necessary information or data could be obtained during the site remedial investigation. The authors will identify the data that ATSDR needs in order to perform a Health Assessment. 6 refs., 9 tabs.

45441 ATSDR's toxicological profiles: A potential for use in site evaluations. Barsotti, D.A. (Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA)); O'Connor, R.C.; Cibulas, W. Jr. pp. 537-538 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

CERCLA as amended requires the Agency for Toxic Substances and Disease Registry (ATSDR) to prepare toxicological profiles for the 275 most hazardous substances found at National Priority List (NPL) sites. A major purpose of these profiles is to provide guidance to public health professionals who must mitigate exposure and address health concerns for persons who live near hazardous waste sites. Each profile is required to include an examination, summary, and interpretation of available toxicological information and epidemiologic evaluations. The information and data are to be used to determine the levels of significant human exposure for the substance and the associated health effects. The profiles must also include a determination of whether adequate information on the health effects of each substance is available or in the process of being developed. In this paper, the authors explain: (1) how the toxicological profiles have been structured to enable the public health professional to evaluate the potential threat to human health from exposure to these chemicals at hazardous waste sites; (2) how public comments on drafts of the first 25 profiles have resulted in improvements to the drafts of the second group of 25 profiles; and (3) how additional information needed to determine the levels of significant human exposure for a chemical will be obtained through a health effects research program ATSDR has developed in consultation with the Environmental Protection Agency (EPA) and the National Toxicology Program (NTP). 2 refs.

45442 The remedial action priority system (RAPS): Comparison between simulated and observed environmental contaminant levels. Whelen, G. (Pacific Northwest Lab., Richland, WA (USA)); Strenge, D.L.; Droppo, J.G. Jr. pp. 539-545 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). DOE Contract AC06-76RL01830. (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Remedial Action Priority System (RAPS) is an objective, physics-based, fully integrated multimedia environmental assessment methodology. RAPS assesses environmental issues associated with hazardous and radioactive mixed-waste sites based on relative human health risk and limited site information. The purpose of this paper is to report on the results associated with applying components of the RAPS methodology to a variety of sites with different contaminant release mechanisms. These applications illustrate the type of data typically required to implement the methodology and several of the types of contaminant releases (e.g., direct discharge, French drain, cribs, tile field and stacks) that can be considered by the methodology. The authors thus demonstrate that applicability of the methodology at a wide variety of sites. The various components of the RAPS methodology have been implemented at actual sites where contaminant levels have been monitored in the environment. The monitored contaminant levels are compared to simulated contaminant levels associated with the application of the RAPS methodology at these sites. The purpose of the comparison is to demonstrate the applicability of implementing RAPS to a wide variety of hazardous waste sites and releases of contaminants into the environment. 21 refs., 13 figs.

45443 Establishing exposure limits and selecting levels of protection for hazardous waste projects. Marlowe, C.S.E. (CDM Federal Programs Corp., Fairfax, VA (USA)); Mathamel, M.S. pp. 546-549 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The OSHA standard for hazardous waste work requires employers to establish limits for chemical exposure. However, most published exposure limits were formulated for use in manufacturing where consistent exposures allow prediction of tomorrow's exposure from yesterday's measurements. Limits are more difficult to apply to the episodic work performed on hazardous waste sites, because, for example, the results found during well drilling 10 days ago may not relate to exposures found during well sampling today. Implementing exposure limits will increase in importance as many sites move from the investigation to the remedial phase, with inherent increased potential for worker exposure. This paper analyzes the fundamental assumptions of commonly used exposure limits such as the OSHA Permissible Exposure Limits and the ACGIH Threshold Limit values in light of experience at hazardous waste sites. This paper also illustrates some assumptions and interpretations that work teams can make to establish exposure limits and level of protection at a waste site without unnecessarily hindering work. Air monitoring and air sampling are used to implement exposure limits with minor modifications, accounting for the mixed nature of wastes, location, and type(s) of task. This paper provides rules of thumb for estimating exposure to vapors at waste sites. The paper also presents procedures for establishing exposure limits for soil aerosols that contain contaminants and for chemicals that do not have published limits. 6 refs., 1 tab.

45444 A new method for uncertainty and sensitivity analysis in public health risk assessments at hazardous waste sites using Monte Carlo techniques in a spreadsheet. Burmaster, D.E. (Burmaster and Associates, Cambridge, MA (USA)); von Stackelberg, K. pp. 550-556 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Following guidance from the US EPA, most public health risk assessments for evaluating hazardous waste sites concatenate a series of (near) worst case assumptions to derive a point estimate of risk that is conservative, i.e., protective of public health. This procedure has three major limitations: First, by setting the bias high enough to swamp the uncertainty in each step, the risk assessment considers scenarios that will rarely if ever happen; second, it is fundamentally not meaningful to run traditional sensitivity analyses (e.g., to make calculations at ±25 or ±50% from the central value of each input variable) to determine the uncertainties in the final point estimates because all the input variables are at or near their maxima; third, current procedures do not offer a systematic way to recalculate an assessment for which the estimated risk is above a de minimus or allowable value, possibly because the input variables are at or near their maxima. This paper presents results from a new method for uncertainty and sensitivity analysis in public health risk assessments at hazardous waste sites using Monte Carlo techniques in a spreadsheet. The new method begins as do conventional methods-with the preparation of a spreadsheet listing the compounds in the first column and having the calculations arrayed across the page from source strength to estimated risk. The new method, however, continues by describing each key input variable in the transport and fate, exposure, and toxicity sections of the spreadsheet as a probability density function (PDF). A commercial spreadsheet program with advanced macro capabilities then computes hundreds of realizations of the overall spreadsheet in a few minutes and presents the PDF for the output as a graph with summary statistics. This method overcomes the limitations of current practices in an easy to use spreadsheet. 24 refs., 10 figs., 2 tabs.

45445 An industrial hygiene program for hazardous waste treatment plant. Mathamel, M.S. (CDM Federal Programs Corp. Fairfax, VA (USA)); Hutton, D.L. pp. 557-560 of Superfund '88 Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

OSHA recently mandated health and safety standards for hazardous waste operations. One of these requirements is the implementation of a comprehensive industrial hygiene (IH) program. This paper describes the IH program developed by CDM Federal Programs Corporation (FPC) for the Stringfellow groundwater pretreatment plant in Glen Avon, California. The plant treats groundwater that is pumped from the Stringfellow hazardous waste site by an underground leachate extraction system. FPC operates the Stringfellow plant under contract to the US Army Corps of Engineers (US COE). A certified industrial hygienist (CIH) designed and implemented the industrial hygiene program for the plant. The Stringfellow plant treats groundwater that contains a wide variety of organic and inorganic chemicals. Plant employees work in a relatively controlled industrial environment; however, the IH program addresses potential chronic exposure to low levels of contaminants, as well as heat stress. The program also balances the requirements of OSHA for personnel working in an essentially industrial environment at a hazardous waste site. The Stringfellow IH program includes a comprehensive medical monitoring and training program for all employees who routinely work in the exclusion zone. It also includes air monitoring and sampling and analysis using both direct reading instruments and air sampling pumps. Because of the potential number of contaminants, several key assumptions were made in designing the monitoring and sampling program. Heat stress monitoring is performed with a computerized wet bulb globe thermometer using a modified work/rest regimen. Radiological exposure monitoring is routinely performed. The results of the monitoring and sampling programs are used to justify the type of personal protective equipment (PPE) required at the plant. A full decontamination facility is provided for plant employees. 9 refs., 2 figs.

45446 Development of a comprehensive air monitoring strategy for worker health at a superfund site. Neely, J.M. (Ecology and Environment, Inc., San Francisco, CA (USA)). pp. 561-564 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

This paper describes the decision logic used to develop an air monitoring protocol at a large Superfund landfill site. The 190-ac. Operating Industries Incorporated (OII) facility had accepted a variety of hazardous solid and liquid wastes, including many volatile organic compounds, which were comingled with household refuse in progressive lifts. The air monitoring program described in this paper was designed to protect workers involved in operating and maintaining existing gas and leachate collection systems and in providing interim erosion control. The air-monitoring strategy consists of a three-phase process that can be applied to similar sites: Background data review; Preliminary speciation and quantification; Specification of air monitoring devices, action levels and sampling

frequencies. The paper details implementation of this process and, based on preliminary program results, discusses the use of certain direct-reading instruments to monitor chronic exposure. 3 refs., 1 fig., 3 tabs.

45447 Federal facility compliance with the emergency planning and Community Right-To-Know act. Hutson, K.A. (Environmental Protection Agency, Washington, DC (USA)). pp. 565-566 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The US EPA has promulgated regulations to implement the Emergency Planning and Community Right-to-Know Act of 1986 (also referred to as Title III of SARA). This statute, which provides an innovative new approach to environmental protection, encourages and supports emergency planning efforts at the State and local level and provides residents and local governments with information concerning potential chemical hazards present in their communities. This paper describes Federal agency actions to comply with the planning, notification and reporting requirements of Title III, even though the provisions of the statute are not legally applicable to Federal agencies.

45448 How to perform an industrial hygiene survey for a hazardous waste site. Mathamel, M.S. (CDM Federal Programs Corp., Fairfax, VA (USA)); Marlowe, C.S.E. pp. 567-568 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The hazardous waste operations standard OSHA 29 CFR 1910.120 mandates that air monitoring and sampling be used to identify and quantify levels of hazardous substances in the air in order to determine the appropriate level of protection for on-site workers. Air monitoring and sampling is an integral part of an overall site industrial hygiene survey, which includes characterization and analysis. Air monitoring to identify conditions immediately dangerous to life and health (IDLH) uses direct reading instruments to measure flammable, oxygen deficient, and toxic atmospheres and radioactive environments. Direct reading instruments can also be used to determine heat stress, or noise exposure hazards. The procedures to perform this type of monitoring are well documented and have become routine in hazardous waste site operations over the past several years. However, the OSHA standard now mandates, for high-risk employees, those closest to the source of contaminant generation, air monitoring and sampling sufficient to characterize employee exposure. This air monitoring requirement has become increasingly important as more cleanups occur, for two reasons: (1) workers involved in cleanup operations are on-site for longer periods of time and are more susceptible to chronic exposure to low levels of contaminants; and (2) remedial work occurs near the point sources of contaminants. Site characterization and analysis, as part of the industrial hygiene survey, needs to include a personal and area monitoring and sampling program. Personal monitoring and sampling has not been routinely performed on hazardous waste sites, and the procedures used in classic industrial hygiene surveys are just now being modified for use on hazardous waste sites. In addition, biohazard sampling may be required. An overview is provided of the process required for an industrial hygiene survey for a hazardous waste site operation. 1 ref.

45449 U.S. Army Installation Restoration Incineration Program at Cornhusker and Louisiana Army Ammunition Plants. Turkeltaub, R.B. (Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD (USA)); Wiehl, C.D. pp. 569-574 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The Army has initiated an Installation Restoration Incineration Program (IRIP) to cleanup explosives contamination at installations resulting from past manufacturing practices. The first two installations in the IRIP are Cornhusker and Louisiana Army Ammunition Plants (AAP). At Cornhusker AAP, groundwater contamination emanating from 48 cesspools and 10 leaching pits has migrated 3 1/2 miles off-post. At Louisiana AAP, the Area P pinkwater lagoons are the source of groundwater contamination that has reached the boundary. Trinitrotoluene (TNT) and cyclotrimethylenetrinitramine (RDX) are the principal contaminants at both installations. Incineration operations have been completed at Cornhusker AAP. Approximately 40,000 tons of explosives-contaminated soil were processed. Incineration operations started at Louisiana AAP in September 1988. This paper describes the implementation of the IRIP at these two installations. 8 refs., 8 figs., 4 tabs.

45450 The use of oxygen in hazardous waste incineration - A state-of-the-art review. Min-Da Ho (Union Carbide Corp., Tarrytown, NY (USA)); Ding, M.G. pp. 575-581 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The use of advanced oxygen combustion technologies in hazardous waste incineration has emerged in the last two years as one of the most significant breakthroughs among all the competing treatment technologies. Unlike most others, oxygen combustion technologies can be easily retrofitted onto various existing incinerators. The capacity of existing incinerators typically can be increased by a factor of two or three, and destruction and removal efficiencies (DREs) potentially can be improved with such a retrofit. The oxygen enrichment of combustion air and the use of oxygen fuel burners in industrial furnaces have been used for years, but with conventional technologies a high oxygen level generally poses problems. The flame temperature is high, leading to high NO_x formation and local overheating. Different technical approaches to overcome these problems and their respective effectiveness will be reviewed. Previously, commercial oxygen enrichment in incinerators was limited to a rather modest level (less than 26% O_2). This paper will review some of the recent commercial applications of much higher oxygen enrichment levels in hazardous waste incinerators. The general characteristics of an oxygen enriched flame, the benefits that can be anticipated and the associated economic ramifications are explored in this paper. Also reported are the results of recent US EPA evaluations of two unique oxygen combustion technologies: the Pyretron burner by American Combustion, Inc. and the LINDE Oxygen Combustion System. 44 refs., 3 figs., 1 tab.

45451 RD and D permitting experience for a mobile pilot infrared incinerator. Berdine, S.P. (Ecova Corp., Dallas, TX (USA)). pp. 582-586 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

In May and June 1987, a generic RD and D Permit Application was submitted to all ten US EPA Regions and several states. Despite a clear congressional directive for flexibility and expeditiousness in the RD and D program, the US EPA has placed little priority on this program. This paper discusses the inconsistencies in Regional reviews and the lack of meaningful directions from US EPA headquarters. 4 tabs.

45452 ENSCO MWP-2000 transportable incinerator. Lanier, J.H. (Environmental Systems Co., Little Rock, AR (USA)). pp. 587-591 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Since 1976, the U.S. Congress has enacted several laws regulating the handling, transportation and disposal of hazardous waste currently generated in the US. In addition, the U.S. Congress also passed CERCLA which regulates and mandates cleanup of uncontrolled hazardous waste sites. These laws form a complex framework which affects nearly every business in America. ENSCO Environmental Services (EES) provides site assessment and remediation services to industry and government. A major service that EES provides is on-site incineration. This paper describes the transportable incinerator, the MWP-2000, that is designed, built and operated by EES. 2 figs., 4 tabs.

45453 Hazardous waste incineration: The process and the regulatory/institutional hurdles. Gupta, G.D. (Enviresponse, Inc.,

Livingston, NJ (USA)); Sherman, A.; Gangadharan, A.C. pp. 592-593 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

A natural result of the Industrial Revolution in the US has been the generation and stockpiling of enormous quantities of waste materials. Significant portions of these wastes have been defined as hazardous by US EPA regulations in accordance with RCRA. It is estimated that US industry generates hazardous waste in excess of 265 million metric tons each year. The majority of these wastes historically have been placed in landfills, and this is true even today. It is estimated that between 1950 and 1975, approximately 5 trillion kg. (6 billion tons) of hazardous waste was deposited on or under the land in the US. The manner in which this waste is being disposed is presented in Table 1. As shown in Table 1, only 5% of these hazardous wastes are being recycled or reused. Industry presently is giving significant attention to increasing the proportions of recycling/reuse of hazardous wastes in an effort to minimize the wastes generated. The present trend of the regulatory agencies is towards elimination of all landfilling of hazardous wastes. Therefore, industry will be left with no alternative except to treat wastes and render them nonhazardous before disposal. Of all the permanent treatment technologies which render waste nonhazardous, incineration is capable of the highest overall degree of destruction and control for the broadest range of hazardous waste streams. A wealth of design and operational experience exists and a wide variety of commercial systems is available. 9 refs., 1 tab.

45454 Cost effective remediation through value engineering. O'Hara, P.F. (Paul C. Rizzo Associates, Inc., Pittsburgh, PA (USA)); Bird, K.J.; Smith, W.C. pp. 594-597 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The recommended remedial action alternatives for a site, whether in the form of a Record of Decision or consent order and agreement, allows a certain degree of flexibility in which several design options may be permissible as long as the intent of these decisions is maintained. A value engineering review allows the A/E to explore that flexibility. A value engineering (VE) review is a less time-consuming and structured process than a formal VE study. A value engineering review examines the major cost components of the recommended alternatives to determine if: More cost-effective remedial actions can be employed, thus achieving the same level of remediation at a lower overall cost; The components of the remedial actions are adequate from an engineering and regulatory standpoint and, if not, what the cost impact of meeting these criteria would be; and The costs presented in the ROD for specific alternatives are realistic and what the potential impact of a more accurate estimate might be. Along with the standard VE issues (i.e., civil construction techniques) environmental VE reviews also address extrinsic issues. These evasive issue (i.e., public risk during construction, unknown nature of hazardous materials, etc.) are qualitatively discussed in VE reviews. Examples of VE reviews presenting these intangible issues ranging from the cost, environment, engineering and emotional points of view are discussed. This paper presents the advantages and disadvantages of VE reviews for environmental remedial design projects. Examples of cost-effective alternative discovered in a VE review of the remedial design process are described. Although VE reviews are routinely performed for government-led remediation projects, they are not routinely used in the private sector. This paper, through examples, makes a case for more use of these techniques in the private sector. 1 ref.

45455 Impact analysis of SARA on the CERCLA remediation program. Fullerton, S. (Engineering-Science, Inc., Atlanta, GA (USA)); Mangan, C.; Matey, J. pp. 598-601 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The range of potential cleanup costs associated with Superfund site remediation was evaluated on the assumption that the US EPA will adopt cleanup standards now under consideration. The study compares in-place containment alternatives to removal, treatment and disposal alternatives in terms of cost and long-term risk. The study also focuses on the national policy implications associated with the preference for permanent solutions, application of applicable or relevant and appropriate requirements (ARARs) and the landfill ban. This study represents the first comprehensive cost impact evaluation to be published on the possible financial impacts of SARA on future Superfund cleanup activities. 3 refs., 3 tabs.

45456 Capital budgeting of risk assessments: How much is a risk assessment worth?. Parris, G.E. (Dynamac Corp., Rockville, MD (USA)). pp. 602-604 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

Corporate risk managers generally have based their loss control and insurance purchasing decisions upon statistical analysis of probable losses. In this process, historical loss data are used to project future losses using the assumption that future conditions can be extrapolated from the past. The inherent weakness of this approach is that it does not account for sudden changes in the system being observed. These changes can be precipitated by: (1) changes in the basic technology involved; (2) changes in statutory law that determine the liability of the operators and owners; and (3) changes in public perceptions and expectations as to how laws should be enforced. The recent difficulties in obtaining comprehensive general liability (CGL), environmental impairment liability (EIL), and product liability insurance can be attributed in part to each of these factors. Starting in the 1960s, the environmental movement contributed to heightened expectations of safety among the general public. The passage of TSCA, RCRA and CERCLA changed the statutory responsibility of industry overnight. The development of more sensitive bioassays and the establishment of the etiology of several diseases were technological changes impacting liability. Corporate risk mangers and insurance actuaries who failed to recognize these events of the 1970s, found the early 1980s to be a very unpleasant experience. 2 refs., 4 tabs.

45457 Recovery for natural resource damages on superfund sites. Landreth, L.W. (Jacobs Engineering Group Inc., Lakewood, CO (USA)). pp. 605-607 of Superfund '88. Hazardous Materials Control Research Institute, Silver Spring, MD (US) (1988). (CONF-881141--: Superfund '88: 9th national conference and exhibition on hazardous waste, Washington, DC (USA), 28-30 Nov 1988).

The current trend in the Superfund process is to focus government efforts on recovery of costs incurred at hazardous waste sites. Much of the controversy related to these efforts is the government's attempts to recover in full for their perceived actual and hypothetical costs of release. While these response costs are being negotiated and litigated strenuously by PRPs, the government, through a trustee, has begun to increase its effort to recover natural resource damages on public areas. The theory behind recovery of natural resource damages, and their broad scope, is in its infancy. At the same time, this component of site costs has the potential to greatly exceed the total cost of the response action taken. The purpose of this paper is to provide the reader a background with which to understand the CERCLA/SARA natural resource damage provisions. Several excellent articles are referenced which will further the reader's understanding of specific natural resource damage topics. 40 refs.

45458 Noteworthy mammal distribution records for the Nevada Test Site. Medica, P.A. (Reynolds Electrical & Engineering Co., Inc., Mercury, NV (USA)). *Great Basin Naturalist (USA)*, 50(1): 83-84 (Mar 1990).

Previous reports on the mammals of the Nevada Test Site, Nye County, Nevada, indicate the presence of 46 species (42 terrestrial mammals and 4 bats). Under a new project entitled Basic Environmental Compliance and Monitoring Program at the Nevada Test Site, two previously uncollected species of mammals were obtained, and a range extension for a third species was documented during the 1988 sampling season. Voucher specimens have been deposited at the Nevada State Museum in Las Vegas, Nevada.

45459 Effects of nutrient recycling and food-chain length on resilience. DeAngelis, D.L. (Oak Ridge National Lab., TN (USA)); Bartell, S.M.; Brenkert, A.L. *American Naturalist (USA)*, 134(5): 778-805 (Nov 1989). DOE Contract AC05-84OR21400.

The attempt to explain the observed structure of ecological food webs has been one of the recent key issues of theoretical ecology. Unquestionably, many factors are involved in determining food-web structure. The dissipation of available energy from one trophic level to the next has been emphasized by Yodzis as the major factor limiting the length of food chains. However, Pimm and Lawton and Pimm have argued that a decrease in relative stability with increasing food-chain length may also be a factor. By relative stability (more commonly, resilience), we mean the rate at which a stable ecological system returns to a steady state following a perturbation. Resilience can be defined more precisely as the inverse of the return time T_R, the time it takes a systems to return a specified fraction of the way toward a steady state following a perturbation. Besides its possible significance to food-web structure, ecosystem resilience is a factor of practical importance, since it is a measure of the rate at which the ecosystem can recover from disturbances. Our purpose is to investigate resilience in food-chain and food-web models as nutrient input and the trophic structure are varied and to offer explanations of the observed model behaviors. In this paper we present the basic results by first using a simple abstract food-chain model at steady state and then showing that these results hold for a more complex food-web simulation model without a constant steady state solution.

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Refer also to citation(s) 43706, 43707, 43710, 43719, 43752, 43753, 43842, 43843, 43844, 43845, 43904, 43924, 43931, 43966, 43996, 44008, 44095, 44096, 44100, 44305, 44358, 44395, 44555, 44570, 45247, 45321, 45324, 45325, 45336, 45339, 45343, 45346, 45347, 45349, 45351, 45354, 45358, 45359, 45366, 45367, 45368, 45371, 45373, 45374, 45378, 45379, 45381, 45385, 45387, 45388, 45392, 45395, 45397, 45398, 45399, 45400, 45401, 45402, 45403, 45404, 45405, 45406, 45407, 45408, 45409, 45410, 45432, 45445, 45641, 45930

45460 (AD-A-221142/3/XAB) **Full-scale implementation of the sodium sulfide/ferrous sulfate treatment process. Final report, October 1987-March 1989.** Beller, J.M.; Carpenter, G.S.; McAtee, R.E.; Pryfogle, P.A.; Suciu, D.F. EG and G Idaho, Inc., Idaho Falls, ID (USA). Sep 1989. 176p. Source: NTIS, PC A09/MF A01.

In Phase I, jar and dynamic testing showed that the sodium sulfide/ferrous sulfate process was a viable method for reducing hexavalent chromium and removing heavy metals from the Tinker AFB industrial wastewater with a significant decrease in sludge production and treatment costs. In Phase II pilot-plant field verification studies were conducted to evaluate the chemical and physical parameters of the chromium reduction process, the precipitation and clarification process, and the activated sludge system. Sludge production was evaluated and compared to the sulfuric acid/sulfur dioxide/lime process. The impact of and procedure for change-over to the sodium sulfide/ferrous sulfate process were also investigated.

45461 (AD-A-221550/7/XAB) **Bioassessment methodologies for the regulatory testing of freshwater dredged material. Phase 2. Final report.** Busacker, G.; Anderson, D.; Gibson, A.; Dillon, T. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab. Mar 1990. 61p. (WES/MP/EL-90-7). Source: NTIS, PC A04/MF A01.

This report represents the second phase of a 3-year (three-phase) project that the Wisconsin Department of Natural Resources (WDNR) requested from the St. Paul District as planning assistance under Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251). The State of Wisconsin is interested in identifying appropriate bioassessment testing methodologies for the regulatory testing of freshwater sediments scheduled for dredging and open-water disposal. The report includes discussions and recommendations for specific approaches to bioassessment methods in the tiered testing protocol. The methods described in this report have the potential to be the most frequently used testing techniques, and represent the backbone of the tiered testing evaluation for regulatory testing of freshwater sediments.

45462 (AD-A-221894/9/XAB) **Installation-restoration program. Stage 3. McClellan Air Force Base. Quality-Assurance Project Plan. Final report, November 1987-May 1990.** Radian Corp., Sacramento, CA (USA). Mar 1990. 282p. Source: NTIS, PC A13/MF A02.

Supersedes QAPP dated Aug 89.

This document has been prepared for the United States Air Force for the purpose of aiding in the implementation of final remedial action plan; and the ongoing nature of the Remedial Investigation/Feasibility Study, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this document, since subsequent facts may become known which may make this document premature or inaccurate. (The attached Radian document has been reviewed as a matter involved in litigation and has been approved for release to the general public.) This document is the McClellan AFB RI/FS Quality Assurance Project Plan (OAPP), and contains procedures for the collection, analysis and documentation for all anticipated sampling and analysis tasks. These include groundwater monitoring well installation, geophysical techniques, and sampling and analysis for groundwater, surface water, sediment, soil, soil vapor, and air.

45463 (CONF-900756-21) **Advances in surface-enhanced Raman spectroscopy for hazardous waste monitoring.** Wachter, E.A.; Haas, J.W.; James, D.R.; Gammage, R.B.; Ferrell, T.L.; Vo-Dinh, T. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit; San Diego, CA (USA); 8-13 Jul 1990. Order Number DE90015539. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Surface-enhanced Raman spectroscopy is being evaluated for use as an advanced method for detecting organic contaminants in groundwater during field-screening of environmental samples. The SERS technique offers attractive and unique capabilities for detecting a wide range of organic contaminants in aqueous environments at ppm to ppb levels. An inexpensive computer-controlled portable spectrometer system coupled to a fiberoptic probe has been developed for rapid on-site and in situ determination of organic contamination in groundwater. Applications of recent advances in substrate fabrication for use with environmental samples are discussed, and critical issues pertaining to substrate durability, repeatability, sensitivity, selectivity and universality are addressed. 9 refs., 5 figs., 1 tab.

45464 (DOE/ER/60845-1) **Adsorption of chromate/organic-acid waste mixtures in aquifer materials: Technical progress report, July 1, 1989-June 30, 1990.** Fish, W.; Palmer, C.D. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA). Dept. of Environmental Science and Engineering. 30 Jun 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-89ER60845. Order Number DE90016191. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Chromate and organic acids are widespread contaminants at DOE contamination sites. These anionic compounds are often found as co-contaminants, along with other anions such as nitrate, cyanide, and fluoride. The mobility of anionic contaminants depends strongly on the extent of adsorption, which occurs primarily to positively charged oxide minerals. Unfortunately, most studies of anion adsorption were conducted on single adsorbates and there has been little examination of the interactive effects of combinations of anionic adsorbates. Furthermore, the adsorptive behavior of many organic acids, even as isolated adsorbates, is poorly understood. This project addresses these problems by elucidating the binding mechanisms of organic acids on mineral surfaces. A combination of wet-chemical and spectroscopic methods are being used. The first year of the project has focused on the adsorption of oxalate, one of the most important organic acids at DOE sites. Goethite has been used as model adsorptive mineral because it is known to be among the most important adsorptive phases in subsurface environments. High purity goethite has been synthesized

and the physical properties fully characterized. Acidic surface functional groups and the corresponding surface charge development of the goethite have been quantified by CO_2-free acidimetric titrations. Accurate isotherms and pH adsorption edges have been determined for oxalic acid on goethite. In the remain out-years of the project, we will focus on the competitive interactions of chromate and organic acids, applying a combination of conventional titration methods and in-situ FTIR surface spectroscopy. Experimental procedures will be expanded to studies of natural aquifer materials found at DOE sites. 12 figs.

45465 (ENEA-RT-PAS--89-24) **Underground water dating by tritium measurements.** Cigna, A.A.; Giorcelli, F.G. ENEA, Saluggia (Italy). Centro Ricerche Energia; ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Dec 1989. 10p. (RT/PAS--89-24). Order Number DE90514464. Source: NTIS (US Sales Only), PC A02.

The changes of tritium concentration in fallout produced by the experimental nuclear weapons exploded in atmosphere may be used, under some conditions, to evaluate the replacement velocity of underground water. The tritium concentrations in fallout at a latitude of 40-45 degrees N since 1950 is reported in this paper. A simple model with two compartments for dating of underground waters with a reduced turnover is also described. As an example, the results obtained from some samples from the karst system of Grotta Grande del Vento - Grotta del Fiume (Ancona, Italy) are included.

45466 (ETDE-IT--90-14) **A novel laser fluorosensor: Preliminary results.** Barbini, R.; Fantoni, R.; Ribezzo, S.; Steen, H.J.L. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. 1990. 4p. (CONF-9007155--2: 15. international laser radar conference, Tomsk (USSR), 23 Jul 1990). Order Number DE90514489. Source: NTIS (US Sales Only), PC A02.

Paper presented at the 15th international laser radar conference (Tomsk, 23-27 Jul 1990).

Short communication WATER POLLUTION CONTROL/excimer lasers; RAMAN SPECTROSCOPY; ENVIRONMENTAL MEASUREMENTS LABORATORY; REMOTE SENSING; TELESCOPES; FLUORESCENCE; ITALY

45467 (LBL--27170) **Annual environmental monitoring report of the Lawrence Berkeley Laboratory.** Schleimer, G.E. (ed.). Lawrence Berkeley Lab., CA (USA). Jun 1989. 40p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC03-76SF00098. Order Number DE90014883. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Environmental Monitoring Program of the Lawrence Berkeley Laboratory (LBL) is described. Data for 1988 are presented and general trends are discussed. In order to establish whether LBL research activities produced any impact on the population surrounding the laboratory, a program of environmental air and water sampling and continuous radiation monitoring was carried on throughout the year. For 1988, as in the previous several years, dose equivalents attributable to LBL radiological operations were a small fraction of both the relevant radiation protection guidelines (RPG) and of the natural radiation background. 16 refs., 7 figs., 21 tabs.

45468 (NUREG/CR--5607) **Flow and transport at the Las Cruces trench site: Experiments 1 and 2.** Wierenga, P.J. (Arizona Univ., Tucson, AZ (USA). Dept. of Soil and Water Science); Hudson, D.B.; Hills, R.G.; Porro, I.; Kirkland, M.R.; Vinson, J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Arizona Univ., Tucson, AZ (USA). Dept. of Soil and Water Science; New Mexico State Univ., Las Cruces, NM (USA). Aug 1990. 413p. Sponsored by Nuclear Regulatory Commission. Source: NTIS, PC A18/MF A01 - GPO; OSTI; INIS.

Two water flow and solute transport experiments were performed as part of a comprehensive field trench study near Las Cruces, New Mexico. These experiments were designed to provide data to test deterministic and stochastic models of vadose zone flow and transport. In Experiment 1, a 4 m by 9 m area was irrigated for 10 days with water containing tritium. Thereafter, water was applied without tritium for an additional 76 days. Simple one-dimensional uniform and layered soil deterministic models for infiltration adequately predicted the overall movement of the wetting front during infiltration, but poorly predicted point values for water content due to spatial variability. Use of the layered soil model, rather than the uniform soil model, did not consistently improve prediction accuracy, for this particular field application. In Experiment 2, a 1.22 m by 12 m area was irrigated for 11.5 days with water containing tritium and bromide. Thereafter, water was applied without tracers for an additional 64 days. Water and bromide moved fairly uniformly during infiltration, whereas high concentrations of tritium developed on one side of the irrigated area. During redistribution, tritium moved little, whereas bromide displayed significant movement both downward and to one side. A two-dimensional deterministic model for water flow showed qualitative, but not quantitative, agreement with observations. A two-dimensional deterministic model for solute transport poorly described tritium and bromide movement during redistribution. 24 refs., 25 figs., 4 tabs.

45469 (OH/RD--89-292-K) **Atikokan TGS [thermal generating station] aquatic studies, 1981 to 1988. 1. Physical characteristics.** Ontario Hydro Research Div., Toronto, ON (Canada). 20 Dec 1989. 48p. (MICROLOG--90-03993). Source: PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN.

This report integrates physical data collected during the course of studies conducted at Atikokan (Ontario) Thermal Generating Station and evaluates the effects of the station on these physical parameters. This station is a lignite-fuelled power plant which draws cooling water from Moose lake and discharges heated water into Snow Lake. The discharge circulates through Snow, Icy, Abie, and Marmion Lakes before returning to Moose Lake. Operation of the station has led to substantial increases in currents in the connecting channels of the cooling circuit and these currents have likely had some influence on sediment erosion and deposition patterns. The thermal discharge has led to increases in the temperature of surface and bottom waters in Snow, Icy and Abie Lakes. The depth of the thermocline in these lakes has also increased. Snow and Icy Lakes and parts of Abie Lake and Marmion Lake (near Abie Lake) are ice-free while the station is operating in the winter. The thermocline of Moose Lake has been lowered substantially as a result of the removal of water by the station. Hypolimnetic oxygen depletion of most of the basins occurs during thermal stratification and to a lesser extent during the winter. Operation of the condenser cooling water pumps during station shutdowns in the winter replenishes oxygen concentrations of bottom water in at least Snow Lake. Water clarity, as measured by Secchi depth, in Icy and Abie Lakes has decreased after station start-up but this observation in not consistent with measurements of turbidity in these lakes. 15 refs., 19 figs., 6 tabs.

45470 (PB--90-186487/XAB) **Superfund Record of Decision (EPA Region 4): Stauffer Chemical/Lemoyne, Al. (First remedial action), September 1989.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 27 Sep 1989. 67p. (EPA/ROD/R--04-89/053). Source: NTIS, PC A04/MF A01.

See also PB--90-186388.

The Stauffer Chemical LeMoyne Site is in Axis, Mobile County, Alabama, approximately 20 miles north of Mobile, Alabama. The area is predominantly industrial, with a few small rural residential communities within a few miles of the site. The Mobile River borders the site to the east. The LeMoyne facility was previously owned by the Stauffer Chemical Company, which began operations in 1953. Now the RCRA-permitted facility is currently owned and operated by Akzo Chemicals, Inc., which purchased the facility in 1987. Multi-product organic and inorganic chemicals are manufactured at the facility. From 1965 to 1974, under the operation of Stauffer, waste from the plant was placed in an unlined landfill located approximately one mile east of the main plant. The waste included 11,000 to 12,000 tons of brine muds in addition to plant refuse, used samples, and absorption oil. The landfill was closed in 1975 with an impermeable membrane cap and side-wall liner. Wastewaters from the processes were held in ponds, some of which discharged to the Cold Creek Swamp. All of the ponds except one are clay lined and have been closed under the direction

of the State. New membrane-lined ponds were installed during the 1970s to replace the closed ponds.

45471 (PB–90-214834/XAB) **Study and analysis of leaking underground-storage-tank remediation techniques incorporated in states in EPA Region 6. Final report.** Kennedy, E. Environmental Protection Agency, Washington, DC (USA). Office of Cooperative Environmental Management. 23 May 1990. 33p. Source: NTIS, PC A03/MF A01.

For system on diskette, see PB–90-502337.

The intent of the research project was initially to determine the effectiveness of groundwater remediation techniques utilized within EPA Region VI for the cleanup of leaking underground storage tanks (LUST). The paper concluded that effectiveness of groundwater remediation is primarily dependent on the choice of remediation parameters rather than the type of technique used. Furthermore, the choice of remediation parameters depends on the value of hydrogeologic parameters that characterize the site and are determined during the initial site assessment.

45472 (PB–90-215062/XAB) **Economic impact analysis of proposed national primary drinking water standards for 24 inorganic and synthetic organic contaminants. Final (Revised).** Environmental Protection Agency, Washington, DC (USA). Office of Drinking Water. Apr 1990. 68p. Source: NTIS, PC A04/MF A01.

The purpose of an RIA (Regulatory Impact Analysis) is to extensively analyze the costs and benefits of alternative regulatory strategies to the proposed rule. Of particular concern is that proper attention is given to small entities and opportunities to reduce economic impacts are fully examined. If, however, a rule is considered to be non-major, an analysis which documents the non-major nature of the rule, with regard to the three criteria above, is sufficient. The purpose of the economic impact analysis is to demonstrate that the proposed regulatory requirements constitute a non-major rule. In that the MCL (Maximum Contaminant Levels) decision for sulfate could be significantly assisted by an in depth analysis of the alternatives, presentation of the estimated sulfate impacts is a second purpose of the report.

45473 (PB–90-222530/XAB) **Health assessment for ALCOA (Vancouver Smelter), Vancouver, Clark County, Washington, Region 10. CERCLIS No. WAD009045279. Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 May 1990. 13p. Source: NTIS, PC A03/MF A01.

The ALCOA (also known as Vancouver Smelter) site, located on the northern bank of the Columbia River about 4 miles west of Interstate 5 in Vancouver, Clark County, Washington, has been proposed for the National Priorities List. The site consists of three waste piles containing about 66,000 tons of waste (spent potlinings and alumina insulation) that were deposited on the north bank of the Columbia River by ALCOA between 1973 and 1981. ALCOA has since sold the aluminum smelter to another company, VANALCO. The contaminants detected in the groundwater in the area surrounding the piles include cyanide, fluoride, and trichloroethene (TCE). The ALCOA site is of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects.

45474 (PB–90-225533/XAB) **Impact of stormwater management practices on ground water. Final report.** Schiffer, D.M. Geological Survey, Altamone Springs, FL (USA). Water Resources Div. 1989. 88p. Source: NTIS, PC A05/MF A01.

Water quality of the surficial aquifer system was evaluated at one exfiltration pipe, two ponds (detention and retention), and two swales in central Florida, representing three runoff detention methods, to detect any effects from infiltrating highway runoff. Concentration of major ions, metals, and nutrients were measured in ground water and bottom sediments from 1984 through 1986. Significant differences for most variables were indicated among ground-water quality data pooled by detention method. Nitrate nitrogen and phosphorus concentrations were highest in ground water near swales and the exfiltration pipe, and Kjeldahl nitrogen was highest near ponds. Results of the study indicate that natural processes occurring in soils attenuate inorganic constituents in runoff prior to reaching the receiving ground water.

45475 (PB–90-225574/XAB) **Health assessment for addendum to Cliff/Dow Dump, Marquette County, Michigan. CERCLIS No. MID980679666.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 13 Sep 1989. 7p. Source: NTIS, PC A02/MF A01.

See also PB–90-107004.

In compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act, as amended, the Agency for Toxic Substances and Disease Registry (ATSDR) has prepared Health Assessment reports for sites currently on, or proposed for, the National Priorities List (NPL). Health Assessments are also prepared for non-NPL sites in response to requests from States and individuals. In the report, the presence and nature of health hazards at this site are assessed, and the public health implications specific to this site are evaluated. The Health Assessment is based on such factors as the nature, concentration, toxicity, and extent of contamination at the site; the existence of potential pathways for the human exposure; the size and nature of the community likely to be exposed; and any other information available to ATSDR that is relevant to a determination of potential risks to public health. Additional Health Assessments may be conducted for this site as more information becomes available to ATSDR. The results of a Health Assessment are essential for determining the need to conduct health effects studies at a particular site.

45476 (PB–90-226150/XAB) **Toxics study of the lower Calcasieu river.** Cunningham, P.; Williams, R.; Chessin, R.; Little, K.; Crocker, P.A. Research Triangle Inst., Durham, NC (USA). Mar 1990. 438p. Source: NTIS, PC A19/MF A03.

The report presents results for a toxics water quality survey of the Lower Calcasieu River Estuary, Louisiana. The study was conducted June-July, 1988, and included toxicity testing of effluents, ambient water and sediments, and priority pollutant chemical analysis of ambient water and sediments. Ten industrial facilities and 35 water quality stations were sampled. This was a cooperative study between U.S. EPA and the Louisiana Department of Environmental Quality and the U.S. Geological Survey to assess water quality impacts due to point source discharges.

45477 (PB–90-227117/XAB) **Everett Harbor Action Program: Analysis of toxic problem areas. Puget Sound estuary program: Final report and appendices. two volumes.** PTI Environmental Services, Bellevue, WA (USA). Sep 1988. 494p. Source: NTIS, PC A21/MF A03.

Also pub. as Tetra Tech, Inc., Bellevue, WA. rept. no. TETRATC-3338-26.

The report presents the results of a field investigation of the nearshore region of the Everett Harbor/Port Gardner/Snohomish River system. Under the Everett Harbor Action Program, federal, state, and local agencies cooperate to respond to toxic contamination problems. Response actions may include regulatory control of point and non-point contamination sources, source treatment, capping or removal of highly contaminative sediments. The study objectives were to: (1) define spatial patterns and quantitative relationships between sediment contamination, toxicity and biological effects; (2) identify problem areas of sediment contamination; (3) rank problem areas for possible remediation; (4) identify potential problem chemicals that display high concentrations in association with biological effects. A standardized assessment technique used in several other Puget Sound Estuary Program urban bay projects was used to identify problem sediments. The primary information used in the problem area ranking process included: (1) sediment characteristics (i.e., contaminant concentrations, conventional physical/chemical characteristics); and (2) biological effects (i.e., benthic invertebrate community structure, sediment toxicity bioassays using amphipods, concentrations of PCB's, chlorinated pesticides and mercury in muscle tissue of English sole, prevalence of liver lesions in English sole).

45478 (PB–90-227125/XAB) **Coquille ocean dredged material disposal site (ODMDS) designation. Final Environmental Impact Statement.** Environmental Protection Agency, Seattle, WA (USA). Mar 1990. 156p. Source: NTIS, PC A08/MF A01.

The final EIS provides information to support designation of an ocean dredged material disposal site (ODMDS) in the Pacific

Ocean off the mouth of the Coquille River in the state of Oregon. The proposed ODMDS is an adjusted location lying north-northeast of an existing, interim-designated site. Site designation studies were conducted by the Portland District, Corps of Engineers, in consultation with Region 10, EPA. The adjusted ODMDS was judged to be a safer location with less potential for adverse environmental effects. No significant or long term adverse environmental effects are predicted to result from designation. The designated ODMDS would continue to receive sediments dredged by the Corps of Engineers to maintain the federally authorized navigation project at Coquille River, Oregon, and other dredged materials authorized in accordance with Section 103 or the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA). Designatin of an ODMDS does not constitute or imply approval of an actual disposal of material. Before any disposal may occur a specific evaluation by Corps must be made using EPA's ocean dumping criteria. EPA makes an independent evaluation of the proposal and has the right to disapprove the actual disposal.

45479 (PB–90-227257/XAB) **Determination whether the causal agent for mussel die-offs in the Mississippi River is of chemical or biological origin. Final report.** Sparks, R.E.; Blodgett, K.D.; Durham, L.; Horner, R. Illinois Natural History Survey, Havana, IL (USA). River Research Lab. Apr 1990. 34p. Source: NTIS, PC A03/MF A01.

Unexplained die-offs of freshwater mussels have occurred in the Mississippi River, including the water of Illinois, from 1982 to 1986. The research was directed at determining the cause, biological or chemical, of these massive die-offs. During the project, over 600 freshwater mussels were collected from the Illinois and Mississippi rivers. Sampling methodologies were developed to collect bacteria associated with various mussel organs and tissues, and the bacterial flora were characterized. This characterization of the bacterial flora of freshwater mussels provides a baseline for comparisons should mussel die-offs resume in the future.

45480 (PB–90-228248/XAB) **Protecting the coastal zone through growth management: The experience of five coastal states. Technical report.** Dolan, K.; Hendrickson, H.B. California Univ., Berkeley, CA (USA). Graduate School of Public Policy. Aug 1989. 106p. Source: NTIS, PC A06/MF A01.

The report is part of the National Network for Environmental Management Studies under the auspices of the Office of Cooperative Environmental Management of the U.S. Environmental Protection Agency. Coastal and growth management programs of five states - California, Florida, New Jersey, Oregon, and Wisconsin - were analyzed to determine effective ways of mitigating environmental consequences. Growth related problems include sewer and highway capacity problems, water quality degradation, reduction of physical and visual access, and loss of habitat. Successful programs commonly share the following characteristics: (1) Strong political leadership; (2) Public support and participation; (3) Coordination between local, state and federal government entities; (4) Policies or legislation to assure consistent enforcement; (5) Attention to housing needs; and (6) Financial support.

45481 (PB–90-228875/XAB) **Health assessment for Berkley Products Dump, Denver, Lancaster County, Pennsylvania, Region 3. CERCLIS No. PAD980539649. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 4 Apr 1990. 12p. Source: NTIS, PC A03/MF A01.

The Berkley Products Dump, an Update 7 site on the National Priorities List, is located in Denver, Lancaster County, Pennsylvania. The landfill was previously used for the disposal of municipal trash, wash solvents, waste paints, resins, and pigment sludges. Landfilling operations were terminated in 1969. A private residence is currently located on the western, nonfilled portion of the site. Other private residences are located adjacent to and downgradient from the site. Low concentrations of organic chemicals and high concentrations of inorganic chemicals were detected in water samples from private wells near the site. Although the use of this water for potable purposes could be of potential health concern, water from contaminated wells is reportedly not being used for potable purposes. Nonpotable use of the water would not be expected to pose a significant health risk. The potential health impacts resulting from contact with other environmental media – such as ambient air, surface soils, and surface waters – could not be assessed because of the absence of supporting analytical data.

45482 (PB–90-228883/XAB) **Health assessment for Missouri Electric Works (MEW) Proposed National Priorities List Site, Cape Girardeau, Missouri, Region 7. CERCLIS No. MOD980965982. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 Nov 1989. 14p. Source: NTIS, PC A03/MF A01.

The Missouri Electric Works (MEW) site has been proposed for listing on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA). The facility sells, services, and remanufactures electric motors, transformers, and transformer controls. It has been in its present location since 1953. Past disposal practices have resulted in polychlorinated biphenyl (PCB) contamination of soil and sediment. Based on the available information, the site is considered to be of potential public health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that may result in adverse human health effects. As noted in the Human Exposure Pathways Section below, human exposure to PCBs may be occurring and may have occurred in the past via ingestion of and dermal contact with on-site soils and sediments. Recommendations are presented to restrict public access and contact with on-site soils and sediments.

45483 (PB–90-228891/XAB) **Health assessment for Centralia Landfill, Centralia, Lewis County, Washington, Region 10. CERCLIS No. WAD980936662. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 4 Apr 1990. 17p. Source: NTIS, PC A03/MF A01.

The Centralia Landfill, an active landfill located on 80 acres of land in Centralia, Lewis County, Washington, has been proposed for addition to the National Priorities List. Wastes have been deposited on about 50 acres of the site. Historically, the landfill accepted municipal wastes and some industrial wastes. Quantities of industrial waste are unknown, but are thought to be small. Contamination may have migrated to the groundwater, surface water, sediment, and biota. Centralia Landfill is of potential public health concern because humans may be exposed to hazardous substances at concentrations that may result in adverse health effects.

45484 (PB–90-228909/XAB) **Health assessment for American Crossarm and Conduit, Chehalis, Lewis County, Washington, Region 10. CERCLIS No. WAD057311094. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 4 Apr 1990. 20p. Source: NTIS, PC A03/MF A01.

The American Crossarm and Conduit Company (Crossarm) site, located on 16 acres of land in Chehalis, Lewis County, Washington, is on the NPL. Wastes from incineration are stored on-site, just north of the wood-treatment building, in double fiberglass bags and 55-gallon drums. These wastes will be stored on-site until it is determined whether the wastes are hazardous. Debris, consisting of broken pallets, barrels, tires, polyvinyl chloride (PVC) pipe, and what appeared to be old iron frames for railroad carts, was piled between the retorts and the chemical storage tanks, as well as in the shed beside the tanks. Sampling results of surface water from Dillenbaugh Creek have shown concentrations of PCP that are of public health concern if the water is ingested. The sediments sampled were contaminated with various forms of dioxin. Sampling results from surface soil samples taken on-site indicate concentrations of PCP and PAH's that are of public health concern if the soil is ingested or if the contaminants in the soil are dermally absorbed. On the basis of the information reviewed, the ATSDR has concluded that the site is of public health concern because humans are probably being exposed to physical hazards that may result in human injuries.

45485 (PB–90-228925/XAB) **Health assessment for Cimarron Mining Corporation, Carrizozo, Lincoln County, New Mexico, Region 6. CERCLIS No. NMD980749378. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 May 1990. 12p. Source: NTIS, PC A03/MF A01.

The Cimarron Mining Corporation, an Update 7 National Priorities List site, is located in the southeastern section of Carrizozo,

Lincoln County, New Mexico. From 1979 to 1982 the site was operated as a milling operation where precious metals were extracted from crushed iron ore by using either sodium cyanide or potassium cyanide mixed with a metal stripper in a leaching process. Currently the site is inactive; however, drums of sodium/potassium cyanide and solid metal stripping and recovery compounds remain on-site. Preliminary environmental monitoring data indicate chromium, cyanide, lead, and nitrate contamination of on-site groundwater, and cyanide contamination of on-site soil, tailings, and wastes. The most likely pathways for contaminant transport to off-site areas appear to be those associated with groundwater and soil. Pathways for human exposure to site-associated contaminants include ingestion of contaminated groundwater and soil and inhalation of contaminated dusts. The site is of potential public health concern because of possible human exposure to site contaminants.

45486 (PB–90-228933/XAB) **Health assessment for Mystery Bridge Road/US Highway 20 Site, Brookhurst Subdivision, Evansville, Natrona County, Wyoming, Region 8. CERCLIS No. WYD981546005. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 4 Apr 1990. 15p. Source: NTIS, PC A03/MF A01.

The Mystery Bridge Road, U.S. Highway 20 site, also known as the Brookhurst Subdivision (BSD), is located adjacent to industrial sites in Wyoming. The sites include a natural gas processing facility, an oil and gas well servicing company, and a railroad siding. Organic chemicals from the industrial sites have contaminated the underlying aquifer and resulted in contamination of downgradient drinking water wells in the BSD. The list of organic contaminants detected on-site include toluene, xylene, benzene, tetrachloroethylene (PCE), 1,1-dichloroethane, trichloroethylene (TCE), and 1,1,1-trichloroethane. An estimated 414 persons in the subdivision rely on groundwater wells for potable water. An alternative supply of potable water has been provided for these residents.

45487 (PB–90-228941/XAB) **Health assessment for Wrigley Charcoal, Wrigley, Hickman County, Tennessee, Region 4. CERCLIS No. TND980844781. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 9 May 1990. 13p. Source: NTIS, PC A03/MF A01.

The Wrigley Charcoal Site (WCS) has been proposed for the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA). WCS is located in Wrigley, Hickman County, Tennessee, about 50 miles southwest of Nashville. Approximately 300 persons reside within a 1-mile radius of the site. About 4,250 persons are supplied with potable water from Mill Creek, located about 1 mile downstream of the site. From information reviewed, the Agency for Toxic Substances and Disease Registry (ATSDR) has concluded that the site is of potential public health concern because of the risk to human health resulting from possible exposure to hazardous substances at concentrations that could result in adverse health effects. Human exposure to phenol, 2,4-dimethylphenol (2,4-DMP), benzene, toluene, ethylbenzene, and naphthalene could occur via ingestion of, inhalation of, and dermal contact with surface water, sediments, soils, ground water, air, and food chain entities.

45488 (PB–90-229832/XAB) **Achieving greater consistency between subjective and objective risks. Final report.** Bord, R.J.; Epp, D.J.; O'Connor, R.E. Pennsylvania State Univ., University Park, PA (USA). Environmental Resources Research Inst. Nov 1989. 128p. (ER–8902). Source: NTIS, PC A07/MF A01.

In the context of a hypothetical Superfund site (or abandoned hazardous waste facility), the research examines strategies for achieving a closer match between risk estimates by citizens and those by scientists. A stratefied sample was interviewed to represent environmental groups, business, civic activists, elected officials, and general population. Respondents were given a scenario about contamination of drinking water from the Superfund site. The scenarios varied in that some included an uncertainty disclaimer. The other variation was in terms of how much citizen participation would be involved in decisions about remedial action, or whether the state would purchase homes that could not be sold at a price representing market value before discovery of the site. Respondents were asked about their level of concern, their perceived risk, and any actions they would take if they lived near the hypothetical site.

45489 (PB–90-231267/XAB) **Intensive studies of stream fish populations in Maine. Final report.** Haines, T.A.; Norton, S.A.; Kahl, J.S.; Fay, C.W.; Pauwels, S.J. Maine Univ., Orono, ME (USA). May 1990. 354p. Source: NTIS, PC A16/MF A02.

The National Acid Precipitation Assessment Program (NAPAP) was established by the Acid Precipitation Act of 1980 to develop and implement a program to increase understanding of the causes and effects of acidic deposition, and their history and prognosis. The objectives of the project were to determine the influence of precipitation chemistry, precipitation amount and character, and stream hydrologic components on biologically important stream chemistry parameters; and to determine the response of fish to episodic and chronic changes in these parameters. The authors selected six streams in eastern Maine for intensive monitoring of stream discharge, temperature, major chemical variables, and fish populations. The chronic effects of acid and Al on two Atlantic salmon life history stages were tested.

45490 (PB–90-231663/XAB) **Hydrogeologic, water-level, and water-quality data from monitoring wells at the US Marine Corps Air Station, Cherry Point, North Carolina. Water Resources investigation.** Murray, L.C.; Keoughan, K.M. Geological Survey, Raleigh, NC (USA). Water Resources Div. 1990. 95p. (USGS-WRI–89-4200). Source: NTIS, PC A05/MF A01.

Also available from Supt. of Docs.

Unlined hazardous-waste disposal sites at the U.S. Marine Corps Air Station, Cherry Point, North Carolina, are located near drinking-water supply wells that tap the Castle Hayne aquifer. Hydrogeologic and water-quality data were collected near 2 of these sites from 12 monitoring wells installed in May through June 1987. The purpose of the report is to present and discuss data collected from four monitoring well clusters installed in May through June 1987 at the Air Station for Phase IIa (the second year) of the ongoing ground-water resource study. Specifically, the report describes (1) hydrogeologic data collected at the four well-cluster sites; (2) the distribution of hydraulic head (water levels) within the intermediate Yorktown aquifer, and temporal and spatial differences in hydraulic head between the surficial, Yorktown, and Castle Hayne aquifers; and (3) the quality of water collected from the surficial and Yorktown aquifers at each of the four well-cluster sites.

45491 (PB–90-231697/XAB) **Hydrogeology of a hazardous-waste disposal site near Brentwood, Williamson County, Tennessee. Water Resources investigation.** Tucci, P.; Withington Hanchar, D.; Lee, R.W. Geological Survey, Nashville, TN (USA). Water Resources Div. 1990. 75p. (USGS/WRI–89-4144). Source: NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

Approximately 44,000 gallons of industrial solvent wastes were disposed in pits on a farm near Brentwood, Tennessee, in 1978. Contaminants associated with these wastes were reported in the soil and shallow ground water on the site in 1985. The purpose of the investigation was to (1) develop an understanding of the geology and ground-water hydrology of the site and surrounding area in order to determine potential contaminant pathways, and (2) to provide sufficient geologic and hydrologic information to enable the State to evaluate remedial-action alternatives and subsequent monitoring of the area. The report documents the results of the investigation, and includes information on geology and hydraulic characteristics of the subsurface materials and on the surface- and ground-water systems of the study area.

45492 (PB–90-231945/XAB) **Geohydrology and groundwater quality at the Pueblo Depot Activity Landfill near Pueblo, Colorado. Water Resources investigation.** Watts, K.R.; Ortiz, R.F. Geological Survey, Denver, CO (USA). Water Resources Div. 1990. 83p. (USGS/WRI–89-4143). Source: NTIS, PC A05/MF A01.

Also available from Supt. of Docs.

The report describes the geohydrologic system and chemical characteristics of ground water at the Pueblo Depot Activity landfill, as required for the issuance of a certificate of designation for the

landfill, and describes the potential effects of the landfill on ground-water quality. Ground-water samples were collected during December 1988 and mid-January 1989 from eight wells, a seep, and an offsite stock tank. These sites and the four piezometers were sampled during February 1989. Water levels were measured in the monitor wells and piezometers to determine depth from land surface to the water table, the water-table altitude, and saturated thickness of the shallow unconfined aquifer at the landfill. Hydraulic characteristics of the aquifer are based on lithologic descriptions and results of aquifer tests in nearby wells with similar lithologic characteristics.

45493 (PB–90-232570/XAB) **Effects of acidic precipitation on the water quality of streams in the Laurel Hill Area, Somerset County, Pennsylvania, 1983-86. Water Resources Investigation.** Geological Survey, Harrisburg, PA (USA). Water Resources Div. 1990. 81p. (USGS/WRI–89-4113). Source: NTIS, PC A05/MF A01.

Also available from Supt. of Docs.

The report describes results of an investigation to quantify the effects of present atmospheric-deposition levels on the water quality of streams within the Allegheny Mountains of southwestern Pennsylvania. The scope of the report is limited to the presentation and discussion of physical and chemical data collected from October 1983 through February 1986 at five first- and second-order watersheds of less than 10.4 km sq. Discussions of the following are included: (1) precipitation quantity and chemical quality; (2) pre- and post-episodic observations of stream constituents; (3) dissolved-constituent response during episodic discharge; and (4) yearly chemical budgets for sulfate, nitrate, base cations, and chloride.

45494 (PB–90-233909/XAB) **Chesapeake Bay Program: Point-Source Atlas.** Macknis, J. Environmental Protection Agency, Annapolis, MD (USA). Chesapeake Bay Program. Aug 1988. 50p. (CBP/TRS–22/88). Source: NTIS, PC A03/MF A01.

The atlas contains pollutant loadings from Chesapeake Bay watershed municipal and industrial point sources drawn from the Chesapeake Bay Program computerized data base. Nutrient and toxic discharges are included. Effluent data are averaged for the calendar year 1985. Detailed information is presented in 23 tables and 14 figures.

45495 (PB–90-233933/XAB) **Arsenic transport and impact in Chesapeake Bay food webs. Attachment A: Arsenic impact on growth, fecundity, species composition and subsequent transport of arsenic in estuarine food webs.** Sanders, J.G.; Osman, R.W.; Sellner, K.G. Environmental Protection Agency, Annapolis, MD (USA). Chesapeake Bay Program. Mar 1988. 141p. (CBP/TRS–18/88). Source: NTIS, PC A07/MF A01.

The report presents a series of separate and linked experiments using cultured and natural communities, combining the control and flexibility of laboratory experimentation with the realism of microcosm studies. Phytoplankton exhibited large changes in growth rate upon exposure to arsenic. Zooplankton were quite resistant to arsenate; benthic organisms also exhibited general tolerance to arsenic.

45496 (PB–90-235102/XAB) **Development of a data base on chemical migration from polymeric materials. Project report, September 1988-September 1989.** Goydan, R.; Hawkins, A.A.; Schwope, A.D. Little (Arthur D.), Inc., Cambridge, MA (USA). Jun 1990. 62p. Source: NTIS, PC A04/MF A01.

A data base was designed and constructed to organize and access data on the migration of chemical substances from polymeric materials. The data base was developed under an interagency agreement between the U.S. EPA and the FDA. The data base will facilitate the thorough and efficient review of chemical migration data and enable the EPA and FDA to maintain an up-to-date compilation of such data. The migration data base was developed using a commercial software package, Advanced Revelation, and runs on IBM personal computers and compatibles. Data elements include the identity of the polymer and migrant(s), the experimental conditions of the migration test, the diffusion coefficient, and the amounts migrated as a function of time, and the data source citation. Data extraction guidelines and data base features for data entry, editing, searching, and reporting were developed based on EPA/FDA operational requirements. All data entered into the data base were extracted from the published literature and FDA indirect food additive petition files. Migration data were entered from ninety citations and include data for 26 polymers and 81 migrants and adjuvants. A User Manual providing detailed user instructions was also prepared.

45497 (PB–90-235128/XAB) **Availability and historical development of ground-water resources on Long Island, New York: An introduction. Water Resources Investigation.** Nemickas, B.; Mallard, G.E.; Reilly, T.E. Geological Survey, Syosset, NY (USA). Water Resources Div. 1990. 50p. (USGS/WRI–88-4113). Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The report explains the scientific aspects of Long Island's ground-water resources, summarizes much of the information obtained during the more than 45 years of the U.S. Geological Survey's study of Long Island's ground-water system, and describes the causes of four selected ground-water-contamination problems and the management responses. The first two sections introduce the basic principles of ground-water occurrence and describe some techniques used to obtain information on this resource. The third section describes the physical characteristics of the Long Island ground-water system, and the fourth section describes the development of Long Island's ground-water resources since the time of the earliest European settlers. The fifth section presents four historic examples of problems that have developed to illustrate the variety of threats to the island's ground-water resources and how management, through a scientific understanding of the resource, has addressed such problems.

45498 (PB–90-235797/XAB) **Laboratory investigation of residual liquid organics from spills, leaks, and the disposal of hazardous wastes in ground water. Final report, April 1986-August 1989.** Wilson, J.L.; Conrad, S.H.; Mason, W.R.; Peplinski, W.; Hagan, E. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). Aug 1989. 285p. Source: NTIS, PC A13/MF A02.

Organic liquids that are essentially immiscible with water migrate through the subsurface through the influence of capillary, viscous and buoyancy forces. Four experimental methods were employed. First, quantitative displacement experiments using short soil columns; second, additional quantitative displacement experiments using long soil columns; third, pore and blob casts; and fourth, etched glass micromodels were used to visually observe dynamic multi-phase displacement processes in pore networks. It was found that the spatial distribution and saturation of organic liquid within the porous media depends on a variety of factors, including: (1) the fluid properties of interfacial tension, viscosity, and density; (2) soil structure and heterogeneity; (3) the number of fluid phases present; and (4) the fluid flow rates. Photomicrographs on a pore scale show that the residual organic liquid appears as blobs, films, rings, and wedges of microscopic size. The size, shape, and spatial distribution of these blobs, films, rings, and wedges affects the dissolution of organic liquid into the water phase, volatilization into the air phase, and the adsorption and biodegradation of organic components. These four processes are of concern in the prediction of pollution migration and the design of aquifer remediation schemes.

45499 (PB–90-235870/XAB) **Superfund Record of Decision (EPA Region 10): Silver Mountain Mine, WA. (First remedial action), March 1990. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 27 Mar 1990. 49p. (EPA/ROD/R–10-90/022). Source: NTIS, PC A03/MF A01.

The five-acre Silver Mountain Mine site is an abandoned mine dump in Okanogan County, north-central Washington. Land in the site vicinity is used primarily for cattle grazing, and the nearest well, two miles away, is used for cattle watering and irrigation. The nearest residence is three miles south of the site. Operations at the mine were initiated in 1902 to extract silver, gold, and copper from soil and ore. From 1980 to 1981, a cyanide leach heap of previously mined material was constructed in an attempt to extract (leach out) silver and gold. The heap consisted of 5,300 tons of ore on top of a 20 ml plastic liner. About 4,400 pounds of sodium cyanide was mixed with water and sprayed on the top of the heap.

The cyanide-laden effluent was then collected in a leachate pond at the base of the heap. The heap leaching operation was abandoned in late 1981 without cleanup of contaminated material. In addition, approximately 5,200 tons of unprocessed mixed material (mine dump) lie to the west of the leach heap. In 1982, the State took action to treat the cyanide at the site using sodium hypochlorite to partially neutralize the leachate pond and heap. In 1985, the State conducted a site stabilization effort, which included removal of liquids from the leachate pond and installation of a 33 ml plastic cover over the heap and pond.

45500 (PB–90-235896/XAB) **Superfund Record of Decision (EPA Region 5): Janesville Old Landfill, WI. (First remedial action), December 1989. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Dec 1989. 69p. (EPA/ROD/R–05-90/120). Source: NTIS, PC A04.

See also PB–90-235904. Portions of this document are not fully legible.

The Janesville Old Landfill site is being remediated concurrently with the Janesville Ash Beds site and two nearby, non-NPL sites, the Janesville Old Dump and the Janesville New Landfill sites. These four sites comprise the 65-acre Janesville Disposal Facility (JDF) in Janesville, Wisconsin. The 18-acre Janesville Old Landfill site was operated from 1963 to 1978, accepting both municipal and industrial wastes. The site was capped with silty sand and sandy clay at the time of closure in 1978, but was subsequently shown to be contributing to air and ground water contamination. A 1986 Consent Order authorized that the four sites comprising the JDF would be addressed in one remedial investigation under the joint authority of CERCLA and RCRA. The primary contaminants of concern affecting the ground water and air are VOCs including benzene, PCE, and TCE; and metals including arsenic. Remedial activities at the JDF site will be implemented at three of the sites and include treating the landfill gas by extraction and flaring, upgrading the landfill cap, and air monitoring at the Old Landfill site.

45501 (PB–90-235904/XAB) **Superfund Record of Decision (EPA Region 5): Janesville Ash Beds, WI. (First remedial action), December 1989. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 29 Dec 1989. 103p. (EPA/ROD/R–05-90/119). Source: NTIS, PC A06.

See also PB–90-235896. Portions of this document are not fully legible.

The Janesville Ash Beds site is being remediated concurrently with the Janesville Old Landfill site and two nearby, non-NPL sites, the Janesville Old Dump and the Janesville New Landfill sites. These four sites comprise the 65-acre Janesville Disposal Facility (JDF) in Janesville, Wisconsin. The Janesville Ash Beds (JAB) site, which is RCRA regulated, operated from 1974 to 1985 and consisted of five ash beds in which industrial liquids and sludges were deposited and allowed to evaporate or dry. The 16-acre Janesville New Landfill site was operated from 1978 to 1985 and accepted municipal and industrial wastes. The second additional site is the 15-acre Janesville Old Dump site which was operated from 1950 to 1963 as a general refuse dump. The primary contaminants of concern affecting the ground water and air are VOCs including benzene, PCE, and TCE; and metals including arsenic. Remedial activities at the JDF site will be implemented at three of the sites and include upgrading the landfill cap, and providing site drainage as needed, at the JAB site; treating the landfill gas by extraction and flaring, upgrading the landfill cap, and air monitoring at the Old Landfill site.

45502 (PB–90-236043/XAB) **Geohydrology, simulation of ground-water flow, and ground-water quality at two landfills, Marion County, Indiana. Water Resources Investigation.** Duwelius, R.F.; Greeman, T.K. Geological Survey, Indianapolis, IN (USA). Water Resources Div. 1989. 146p. (USGS/WRI–89-4100). Source: NTIS, PC A07/MF A01.

The report presents the results of a study to provide a quantitative evaluation of the ground-water flow system at the Julietta and Tibbs-Banta landfills and provide a general description of the ground-water quality beneath and near the two landfills. These objectives provide the information necessary to evaluate the effects of the landfills on ground-water quality. Geologic, hydrologic, and water-quality data were collected in 1985 and 1986 at the Julietta and Tibbs-Banta landfills to fulfill the study objectives. Ground-water models were used to investigate the flow systems and estimate the volume of flow at the landfills. The report includes descriptions of the data collection, geologic and hydrologic descriptions of the two landfills, and brief histories of trash and sludge disposal. Ground-water-flow models are described and estimates of the volume of flow are discussed. A description of the quality-assurance plan used in conjunction with the water-quality data collection and analysis is included. Water-quality data are presented with statistical summaries of ground-water quality related to well depth and position in the flow system.

45503 (PB–90-236753/XAB) **Hydrogeology and simulation of ground-water flow at Superfund-site wells G and H, Woburn, Massachusetts. Water Resources Investigation.** de Lima, V.; Olimpio, J.C. Geological Survey, Reston, VA (USA). Water Resources Div. 1990. 106p. (USGS/WRI–89-4059). Source: NTIS, PC A06/MF A01.

Also available from Supt. of Docs.

The area around wells G and H, two former public-supply wells for the city of Woburn, Massachusetts and currently designated as a U.S. Environmental Protection Agency Superfund site, was the focus of intensive hydrogeologic investigations from 1983 to 1988. The U.S. Geological Survey has provided assistance to the U.S. Environmental Protection Agency for the site since 1985. The report includes hydrogeologic information and describes a three-dimensional, digital ground-water-flow model that was designed and calibrated by the U.S. Geological Survey for use by the U.S. Environmental Protection Agency to evaluate alternative pumping scenarios in developing an aquifer cleanup strategy.

45504 (PB–90-242017/XAB) **Health assessment for Standard Auto Bumper Corporation, Hialeah, Dade County, Florida, Region 4. CERCLIS No. FLD004126520. Preliminary report.** Florida State Dept. of Health and Rehabilitative Services, Tallahassee, FL (USA). 31 May 1990. 23p. Source: NTIS, PC A03/MF A01.

The Standard Auto Bumper Corporation proposed National Priorities List (NPL) site is located in Hialeah, Dade County, Florida. Contaminants in on-site surface soil, subsurface soil, and ground water at levels likely to be of health concern include the following plating wastes: chromium, copper, iron, lead, nickel, and zinc. Polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) have also been found both on site and in the immediate vicinity. The presence of PCBs and PAHs cannot be attributed to use at the facility on the basis of currently available information. The site is of potential public health concern because of the risk to human health from possible exposure to hazardous substances at levels that may result in adverse health effects. The site has been under a removal Administrative Order by consent with the Environmental Protection Agency (EPA) since April 1987 and contaminated soil removal is under way. The population of concern includes workers on the site and workers from surrounding buisnesses that may come in contact with soil from the off-site drainage areas. The area has not been surveyed for down gradient private potable wells but city water is available to the area.

45505 (PB–90-243999/XAB) **Health assessment for General Electric (Spokane Shop), Spokane, Washington, Region 10. CERCLIS No. WAD001865450. Preliminary report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 1 Jun 1990. 17p. Source: NTIS, PC A03/MF A01.

The U.S. Environmental Protection Agency (EPA) added the General Electric (Spokane Shop) (GE) site, located in Spokane, Washington, to the National Priorities List (NPL) in October 1989. From 1961 until 1980, the facility was used for the repair and restoration of electric motors, transformers, switchgear, pumps, compressors, and related equipment. Polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and metals were found in a variety of environmental media at the site as a result of leaking transformers, cleaning operations, and servicing operations at the facility. Human exposure to PCBs, VOCs, and metals may occur or may be occurring and may have occurred in the past via ingestion, inhalation, or dermal absorption of contaminants in groundwater; inhalation of windblown contaminated dust particles;

dermal absorption of contaminants in the soil; or inhalation of contaminants that may volatilize into the air.

45506 (PB–90-247107/XAB) **Health assessment for Upper Deerfield Township Sanitary Landfill, Upper Deerfield Township, Cumberland County, New Jersey, Region 2. CERCLIS No. NJD980761399. Final report.** New Jersey Dept. of Environmental Protection, Trenton, NJ (USA). 20 Jun 1990. 15p. Source: NTIS, PC A03/MF A01.

In compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act, as amended, the Agency for Toxic Substances and Disease Registry (ATSDR) has prepared Health Assessment reports for sites currently on, or proposed for, the National Priorities List (NPL). Health Assessments are also prepared for non-NPL sites in response to requests from States and individuals. In the report, the presence and nature of health hazards at the site are assessed, and the public health implications specific to the site are evaluated. The Health Assessment is based on such factors as the nature, concentration, toxicity, and extent of contamination at the site; the existence of potential pathways for the human exposure.

45507 (PB–90-502311/XAB) **Toxic release inventory (TRI), 1987 (for CD-ROM). Data file.** Nowak, G.D.; Merrick, E. Environmental Protection Agency, Washington, DC (USA). Office of Toxic Substances. 1987. vp. Source: NTISCD-ROM $45.00.

See also PB–90-502030 and PB–89-186068. Includes search and retrieval software on two 360K, 5 1/4-inch diskettes, double sided, and user instructions. System: DOS Compatible; PC DOS 3.0 operating system. Microsoft Extensions 2 or higher is required. The data file is contained on one 4.72 inch disc. Data format: ISO 9660. Issued annually.

Section 313 of the Emergency Planning and Community Right-to-Know Act (also known as Title III) of the Superfund Amendments and Reauthorization Act of 1986 (Public Law 99-499) requires EPA to establish a National Inventory of toxic chemical emissions from certain facilities. The following information is required: the name, location and type of business; off-site locations to which the facility transfers toxic chemicals in waste; whether the chemical is manufactured (including importation), processed, or otherwise used and the general categories of use of the chemical; an estimate (in ranges) of the maximum amounts of the toxic chemical present at the facility at any time during the preceding year; quantity of the chemical entering each medium - air, land, and water - annually; waste treatment/disposal methods and efficiency of methods for each waste stream; optional information on waste minimization; and a certification by a senior facility official that the report is complete and accurate. The law mandates that the data be made publicly available through a computer database.

45508 (PB–90-502337/XAB) **Leaking underground storage tank (LUST) site characteristics data base (for microcomputers). Data file.** Dail, L.; Kennedy, E. Environmental Protection Agency, Washington, DC (USA). Office of Cooperative Environmental Management. 1990. vp. Source: NTISCP D02.

The data file is contained on 5 1/4-inch diskettes, high density (1.2M), compatible with the IBM PC microcomputer. The diskettes are in the dBase III+ format. Price includes documentation, PB–90-214834.

The diskette contains the actual data collected to write the report using common parameters that are routinely employed by environmental consultants when evaluating leaking underground storage tank (LUST) sites. These parameters include the hydraulic gradient, hydraulic conductivity, depth to groundwater or potentiometric surface, aquifer thickness, type of aquifer, porosity and local geology. The data were collected primarily from sites located in Texas and New Mexico and was obtained from available state records.

45509 (PB–90-872508/XAB) **Asbestos removal. February 1972-May 1990 (A Bibliography from the NTIS data base). Report for February 1972-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 111p. Source: NTISPC N01/MF N01.

Supersedes PB–89-865091.

This bibliography contains citations concerning methods of removing asbestos from buildings and water. Walk-through survey reports describe wet and dry removal techniques being employed at work sites. Containment barriers, ventilation systems, and vacuum systems used during asbestos removal projects are also described. Monitors that measure asbestos dust fibers, and water filters that remove asbestos are also discussed. Alternative uses in highways and as an absorbing agent in oil spill cleanups are explored along with disposal methods. (This updated bibliography contains 185 citations, 78 of which are new entries to the previous edition.)

45510 (PB–90-872847/XAB) **Health assessment: Volatile compounds in ground-water. January 1990-April 1990 (A Bibliography from the NTIS data base). Report for January 1990-April 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 119p. Source: NTISPC N01/MF N01.

This bibliography contains citations concerning volatile organic compounds in groundwater, and the assessment of their effects on public health. Among the compounds included are trichloroethylene, trichlorethane, benzene, ethylbenzene, toluene, xylene, methylene chloride, pentane, carbon tetrachloride, and chloroform. Citations cover specific sites, known landfills, municipal water supplies, and sites on the National Priorities List. Monitoring data and risk assessments are included. (Contains 257 citations fully indexed and including a title list.)

45511 (PNL-SA–17438) **Natural radionuclides in groundwaters.** Laul, J.C. Pacific Northwest Lab., Richland, WA (USA). Jan 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900125–1: 3. international conference on low-level measurements of actinides and long-lived radionuclides in biological and environmental samples, Bombay (India), 29 Jan - 2 feb 1990). Order Number DE90015286. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The U-234 and Th-230 radionuclides are highly retarded by factors of 10^4 to 10^5 in basalt groundwater (Hanford) and briny groundwaters from Texas and geothermal brine from the Salton Sea Geothermal Field (SSGF). In basalt groundwaters (low ionic strength), Ra is highly sorbed, while in brines (high ionic strength), Ra is soluble. This is probably because the sorption sites are saturated with Na^+ and Cl^- ions and $RaCl_2$ is soluble in brines. Pb-210 is soluble in SSGF brine, probably as a chloride complex. The U-234/Th-230 ratios in basalt groundwaters and brines from Texas and SSGF are nearly unity, indicating that U is in the +4 state, suggesting a reducing environment for these aquifers. 19 refs., 3 figs.

45512 (UCRL–21008-Vol.8) **Evaluation of military field-water quality: Volume 8: Performance of Mobile Water-Purification Unit and pretreatment components of the 600-GPH Reverse Osmosis Water- Purification Unit, and consideration of Reverse Osmosis bypass, potable-water disinfection and water-quality analysis techniques.** Selleck, R.E. (California Univ., Richmond, CA (USA). Sanitary Engineering and Environmental Health Research Lab.); Ungun, Z.; Chesler, G.; Diyamandoglu, V.; Marinas, B.; Daniels, J.I. Lawrence Livermore National Lab., CA (USA); Army Medical Research and Development Command, Fort Detrick, MD (USA). May 1990. 113p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90015410. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A comparison is made between the performances of the 600-gph Reverse Osmosis Water Purification Unit (ROWPU) operated in the bypass mode and the Mobile Water Purification Unit (MWPU, frequently referred to as an ERDLATOR because the equipment was developed at the Engineer Research and Development Laboratory at Fort Belvoir, VA.) Generally, the performance of the MWPU is significantly better than the pretreatment units of the ROWPU in terms of removing both turbidity and pathogenic organisms. It is recommended that the practice of bypassing the reverse osmosis (RO) components of the ROWPU be avoided unless it can be demonstrated clearly that the cartridge filters will remove the cysts of infectious organisms effectively and reliably. If the ROWPU must be operated in the bypass mode, it is recommended that the dose of disinfectant used be made equal to that currently employed in the field for untreated raw water. The analytical methods used to determine total dissolved solids (TDS) and residual free chlorine with the new Water-Quality Monitor (WQM) are also reviewed briefly. The limitations of the methods used to calibrate the TDS

and free-chlorine probes of the new WQM are discussed. 98 refs., 19 figs., 16 tabs.

45513 Chemical composition of ground water and the locations of permeable zones in the Yucca Mountain area, Nevada. USGS Open-File Report 83-854. Benson, L.V.; Robison, J.H.; Blankennagel, R.K.; Ogard, A.E. 19p. Geological Survey, Denver, CO (US) (1983).

Ten wells in the Yucca Mountain area of southern Nevada have been sampled for chemical analysis. Samples were obtained during pumping of water from the entire well bore and in one instance by pumping water from a single isolated interval in well UE-25b number 1. Sodium is the most abundant cation and bicarbonate the most abundant anion in all water samples. Although the general chemical compositions of individual samples are similar, there are significant differences in uncorrected carbon-14 age and in inorganic and stable-isotope composition. Flow surveys of seven wells performed using iodine-131 as a tracer indicate that groundwater production is usually from one or more discrete zones of permeability. 7 refs., 12 figs., 1 tab.

45514 Geohydrologic data for test well UE-25B number 1, Nevada Test Site, Nye County, Nevada. USGS Open-File Report 83-855. Lobmeyer, D.H.; Whitfield, M.S.; Lahoud, R.G.; Bruckheimer, L. 48p. Geological Survey, Denver, CO (US) (1983).

Data were collected to determine the hydraulic characteristics of rocks penetrated in test well UE-25b number 1. This well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site in a program conducted in cooperation with the US Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for storage of high level radioactive wastes. Data on drilling operations, lithology, core analyses, borehole geophysics, hydrologic monitoring, hydraulic testing, and groundwater chemistry for test well UE-25b number 1 are reported. 3 refs., 28 figs., 5 tabs.

45515 Environmental assessment of remedial action at the Riverton uranium mill tailings site, Riverton, Wyoming. Volume I: Text. 219p. Environmental Monitoring and Support Laboratory, Cincinnati, OH (US) (1984).

This document assesses and compares the environmental impacts of various alternatives for remedial action at the Riverton uranium mill tailings site located 2 miles southwest of Riverton, Wyoming. The site covers 173 acres and contains 70 acres of tailings and several of the original mill structures. The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), Public Law 95-604, authorizes the US Department of Energy to clean up the site to reduce the potential health impacts associated with the residual radioactive materials remaining at the site and at associated properties off the site. The US Environmental Protection Agency promulgated standards for the remedial actions. Remedial actions must be performed in accordance with these standards and with the concurrence of the Nuclear Regulatory Commission. The preferred alternative is to stabilize the tailings at their present location by consolidating the tailings and associated contaminated soils into a recontoured pile. A radon barrier of compacted earth would be constructed over the pile, and various erosion control measures would be taken to assure the long-term stability of the pile. An underground bentonite slurry wall would be constructed around the perimeter of the stabilized pile to minimize additional groundwater contamination. Another alternative which would involve moving the tailings to a new location is also assessed in this document. This alternative would generally involve greater short-term impacts and costs but would result in stabilization of the tailings at a more remote location. The no action alternative is also assessed in this document. 105 refs., 24 figs., 16 tabs.

45516 Particulate organic sulfur in the waters of the southern California Bight. Matrai, P.A. (Scripps Institution of Oceanography, La Jolla, CA (USA)); Eppley, R.W. *Global Biogeochemical Cycles (USA),* 3(1): 89-103 (Mar 1989). DOE Contract FG05-85ER60336 ;FG05-85ER60339.

The organic sulfur content of suspended and sinking particulate matter was examined in the upper 1,000 m of the water column in the Southern California Bight. Depth distributions (POS) showed a subsurface maximum in most stations that deepened offshore. POS concentrations in suspended matter averaged 1.26 + or−0.50 micrograms S/1 within the euphotic zone during the two cruise analyzed (August and October, 1987). The downward fluxes of mass, carbon, nitrogen and sulfur of sinking particulate matter increased with increasing sample depth to 350 m in the water column. Fluxes were similar during the three deployments. POS was correlated with and directly proportional to particulate organic carbon, particulate organic nitrogen, and chlorophyll a in the suspended material. Similar correlations wee obtained in the trap material although a positive POC intercept value suggested the presence of more refractory material, with sulfur being selectively removed relative to carbon. The average molar ratios were C:N:S: = 224:27:1 in suspended and 119:17:1 in sinking particulate organic matter. Particulate organic sulfur appeared to have a biological origin most likely planktonic. 42 refs., 6 figs., 4 tabs.

45517 Retention of passive integrated transponder tags in largemouth bass brood fish. Harvey, W.D. (Texas Parks and Wildlife Dept., Austin (USA)); Campbell, D.L. *Progressive Fish and Culturist (USA),* 51(3): 164-165 (Jul 1989).

Passive integrated transponder (PIT) tags were injected into 22 largemouth bass (Micropterus salmoides) brood fish to determine the retention rate of the tags, the effect on spawning success, and the utility of the tags as a means of individual fish identification. Fish were evaluated 12, 17, and 24 months after implantation. All tags were retained and all tagged fish were recognized. Tag injection and retention had no discernible effect on spawning success.

45518 The influence of surface state and saturation state on the dissolution kinetics of biogenic aragonite in seawater. Acker, J.G. (Univ. of South Florida, St. Petersburg (USA)); Byrne, R.H. *American Journal of Science (USA),* 289(9): 1098-1116 (Nov 1989).

Laboratory observations of aragonite dissolution in seawater, under temperature and pressure conditions that approximate the natural oceanic environment, indicate that $R = k'([CO^{2-}_3]_s - [CO^{2-}_3])^n$ is an appropriate expression describing the dependence of dissolution rate on seawater saturation, state, where R is aragonite dissolution rate in percent per day, $[CO^{2-}_3]_s$ is the carbonate ion concentration at saturation, and $[CO^{2-}_3]$ is the in-situ carbonate ion concentration. Under conditions in which the influence of surface alteration is minimized, plots of dissolution rate, R, versus $([CO^{2-}_3]_s - [CO^{2-}_3])$ approach linearity. Consequently, in the absence of surface alteration effects, our results suggest that the reaction order, n, in the above expression should be equal to one. Use of single pteropod shells in extended experimental sequences indicates that progressive roughening of the shell surface by dissolution can substantially enhance shell dissolution rates. Surface alteration leads to variable values of the rate constant, k′, in the expression above. For rate measurements obtained at increasing degrees of both undersaturation and shell roughness, the multiplicative factors k′ and $([CO^{2-}_3]_s - [CO^{2-}_3])$ give rise to curvature in plots of rate versus $([CO^{2-}_3]_s - [CO^{2-}_3])$. For models in which variations in k′ are not explicitly acknowledged, dissolution rates are generally described successfully with reaction orders (n) greater than one. Our experiments, performed at variable pressure, were modeled using several realistic partial molar volume changes (δ V) for aragonite dissolution in seawater.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 44903, 45909

5502 Biochemistry

Refer also to citation(s) 44075, 44942, 44951, 45912, 45915

45519 (BNL–44758) **The localization of solvent in protein crystals.** Schoenborn, B.P.; Cheng, Xiaodong. Brookhaven National Lab., Upton, NY (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9007150–1: International biophysics congress satellite symposium,

Whistler (Canada), 23-27 Jul 1990). Order Number DE90015671. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In protein crystallography, it has been customary to ignore the contribution of bulk solvent by omitting the low-order diffraction data in refinement procedures. These data contain, however, important information concerning the gross features of the unit cell contents particularly the solvent structure. The contribution of the solvent to the low-order structure factor terms has been evaluated by dividing the solvent volume into shells extending outward from the protein surface. Two hydration layers in myoglobin crystals have thus been characterized, which allows a better evaluation of the protein's surface structure, improved placement of bound water, ion molecules and a better overall fit to the observed data as well as an improved solvent density Fourier map. 17 refs., 3 figs.

45520 **Cold spring harbor symposia on quantitative biology: Volume 53, Molecular biology of signal transduction.** 550p. The Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1988). Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60666. From 53. symposium on the molecular biology of signal transduction; Cold Spring Harbor, NY (USA); 25 May - 1 jun 1988.

For many decades, it has been clear that cells have a multitude of ways of sensing their environment and converting a plethora of external signals into measured intracellular responses. Now we realize that many first messengers do not act directly through second messengers, but instead work at the genetic level by binding to cytoplasmically located receptors, which can then bind to DNA and turn on or off the functioning of specific genes. Today, we refer to the way that external signals are passed through various cellular components as signal transduction processes, with receptors and their associated molecules known as biological transducers. Because most transducer molecules are present in very limited amounts, their study at the biochemical level until recently was at best difficult, and hypothesis as to how they functioned were almost impossible to test rigorously. Today, recombinant DNA techniques have dramatically changed the picture. Even very rare receptors are now open to analyses if their respective genes can be cloned, and virtually every month, the amino acid sequence of a new key biological transducer is established. The time was thus appropriate last June to hold a Cold Spring Harbor Symposium on the Molecular Biology of Signal Transduction. The final program consisted of 119 speakers, who spoke before an audience of 439, the largest ever yet to attend a Cold spring Harbor Symposium. This volume contains 61 papers. Individual papers are indexed separately on the energy data base.

45521 **Cold spring harbor symposia on quantitative biology: Volume 53, Molecular biology of signal transduction: Part 2.** 473p. The Cold Spring Harbor Laboratory, Cold Sring Harbor, NY (1988). Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60666. From 53. symposium on the molecular biology of signal transduction; Cold Spring Harbor, NY (USA); 25 May - 1 jun 1988.

For many decades, it has been clear that cells have a multitude of ways of sensing their environment and converting a plethora of external signals into measured intracellular responses. Now we realize that many first messengers do not act directly through second messengers, but instead work at the genetic level by binding to cytoplasmically located receptors, which can then bind to DNA and turn on or off the functioning of specific genes. Today, we refer to the way that external signals are passed through various cellular components as signal transduction processes, with receptors and their associated molecules known as biological transducers. Because most transducer molecules are present in very limited amounts, their study at the biochemical level until recently was at best difficult, and hypotheses as to how they functioned were almost impossible to test rigorously. Today, recombinant DNA techniques have dramatically changed the picture. Even very rare receptors are now open to analysis if their respective genes can be cloned, and virtually every month the amino acid sequence of a new key biological transducer is established. The time was thus appropriate last June to hold a Cold Spring Harbor Symposium on the Molecular Biology of Signal Transduction. The final program consisted of 119 speakers, who spoke before an audience of 439, the largest ever yet to attend a Cold Spring Harbor Symposium. This volume contains 54 papers. Individual papers are indexed separately on the energy data base.

45522 (DOE/ER/14071–1) **Molecular biology of Lea genes of higher plants: Progress report.** Dure, L. III. Georgia Univ., Athens, GA (USA). Dept. of Biochemistry. Jun 1990. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG09-89ER14071. Order Number DE90015818. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report discusses progress from the past 8 months. Our research has centered around 4 aspects of the research proposed in the initial grant: purification and sequencing of cDNAs for the LEA protein D-78, visualization of tissue/cell type expression of the Lea genes, synthesis of LEA proteins in E. coli, and computer modeling of LEA D-7.

45523 (DOE/ER/25019–19) **The mathematical analysis of bursting electrical activity in pancreatic beta cells.** Pernarowski, M. Washington Univ., Seattle, WA (USA). Jul 1990. 166p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER25019. Order Number DE90016119. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Pancreatic β-cells exhibit periodic bursting electrical activity (BEA) consisting of active and silent phases. Experimentally, the ratio of the active phase duration to the overall period, ρ_f, has been correlated to the insulin-glucose response of these cells. Many different mathematical models of the β-cell have been developed to describe changes in the intracellular ionic concentrations and the ionic flow through the cellular membrane. The membrane potential in these models exhibit the same active and silent phase bursting patterns as those observed experimentally and therefore can be used to predict the value of the plateau fraction, ρ_f. The Sherman-Rinzel-Keizer (SRK) mathematical model of this phenomenon consists of three coupled first-order nonlinear differential equations which describe the dynamics of the membrane potential, the activation parameter for the voltage-gated potassium channel, and the intracellular calcium concentration. These equations are transformed into a Lienard differential equation coupled to a single first-order differential equation for the slowly changing nondimensional calcium cocentration. Leading-order perturbation problems for the silent phase and the transition regions are reduced to quadrature. The solution of the leading-order active phase problem is a limit cycle which depends on the value of the intracellular calcium concentration. Since the active phase equations exhibit weak damping, Melnikov's method can be applied to determine the bifurcation point of these equations. Thus, an explicit expression for the active phase duration is obtained. Together with the silent phase analysis, an approximation of the plateau fraction, ρ_f, is derived and its value compared to the plateau fraction numerically obtained from the SRK model. 47 figs., 11 tabs.

45524 (INIS-mf–12090) **A radiometric method for determination of the activity of UDP-galactose-4-epimerase.** Eign, C. Muenchen Univ. (Germany, F.R.). Medizinische Fakultaet. 12 Feb 1987. 49p. (In German). Order Number DE90706124. Source: NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The comparative analysis of various methods for the determination of the epimerase has been done with different types of tissue (also in the erythrocytes) and has shown that the radiometric method is more accurate than the spectrophotometry, and is suitable for examination of patients who show the symptoms of classical galactosemia.

45525 (INIS-mf–12094) **DNA hybrids suggesting a recombination process repairing radiation-induced DNA double-strand breaks in Ehrlich Ascites tumor cells.** Barthel, H.R. Frankfurt Univ. (Germany, F.R.). Fachbereich 19 - Humanmedizin. 29 Oct 1984. 109p. (In German). Order Number DE90706127. Source: OSTI.

The results presented suggest the possibility of repair of DNA doublestrand breaks by recombination, at least in the S and G_2-phase of the cell cycle, in mammalian cells. Further experiments with synchronized cell cultures will have to show whether this process may also occur in the G_1-phase of the cell cycle.

45526 (LBL–29240) **Origins and determinants of HDL populations and their subpopulations.** Nichols, A.V.; Gong, E.L. Lawrence Berkeley Lab., CA (USA). Jun 1990. 23p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC03-76SF00098. (CONF-9006254–1: Karolinska hospital symposium on disorders of HDL, Stockholm (Sweden), 6-8 Jun 1990). Order Number DE90015316. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the origins and determinants of High Density Lipoproteins (HDL) populations and their subpopulations. Our survey of compositional properties of small HDL particles indicates considerable variation in core lipid content reflecting in large part the origins of such particles. Whether small HDL particles of different core content and apolipoprotein composition differ in their metabolic properties and function in reverse cholesterol transport remains to be established. Our studies demonstrate that lipolysis-derived products can facilitate formation in vitro of small Apolipoprotein (AI) particles with properties approximating those of plasma pre-β HDL. Of particular interest is our observation that small AI particles are an exclusive reassembly product in mixtures containing POPE and FFA. This observation may be relevant to the physiologic origins of PE in lipoprotein structure and its role in metabolism and secretion of nascent HDL. Lastly our observations on the reactivity of small AI particles, containing FFA, with LCAT and LDL suggest further linkages between triglyceride and HDL metabolism. 19 refs., 4 figs., 5 tabs.

45527 (ORNL/FTR–3695) **[Biological applications of nucleosides and nucleotides]: Foreign trip report, July 27, 1990–August 4, 1990.** Srivastava, P.C. Oak Ridge National Lab., TN (USA). 20 Aug 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015836. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler was invited to visit The Meditech Group, VTT Technology, Inc., Reactor Laboratory, VTT Technical Research Center of Finland (VTT), Otakaari, Espoo, Finland. The Meditech Group commands a 70 percent market share of Finland's radiopharmaceutical business and plans to expand its activities to other Scandinavian countries as well as in the Leningrad area of USSR. Meditech has plans to separate itself from Technical Research Center of Finland and its subsidiary VTT Technology, Inc., to become a private radiopharmaceutical company in the near future. As a private company, Meditech could expand its activities to encompass radiopharmaceutical research and development and may require foreign technical experts to support its research endeavors. The traveler also attended the Ninth International Round Table Conference on Nucleosides, Nucleotides, and Their Biological Applications held at the Biomedical Center, University of Uppsala, Uppsala, Sweden. The meeting focused on the chemistry and biology of RNA and DNA and their building blocks, nucleosides and nucleotides. The traveler also presented an invited paper entitled "Design, Synthesis and Tumor Specificity of Azomycin Ribo- and Acyclonucleosides," describing his recent work at Oak Ridge National Laboratory.

45528 (PB–90-224874/XAB) **Biotechnology-based development. Opportunities and issues in technology transfer and commercialization.** Varadarajan, S. United Nations Industrial Development Organization, Vienna (Austria). 1989. 20p. (UNIDO-IPCT.–102). Source: NTIS, PC A03/MF A01.

The expert report on opportunities and problems arising from technology transfer and application of biotechnology - covers (1) features and requirements for the use of biotechnology in developed countries and in developing countries, regarding consequences for human health and fertility, environmental quality and agriculture; (2) conditions for commercialization, such as industrial safety and a suitable institutional framework.

45529 **Automated cell separation techniques based on optical trapping.** Buican, T.N. (Los Alamos National Lab., NM (USA)). pp. 15, Paper I & EC 42 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The authors describe two cell separation techniques developed in their laboratory: (1) laser sorting, based on the use of two weakly collimated laser beams which propel single cells through an analysis volume and, depending on the measured properties of each cell, towards one of several collection volumes; and (2) microrobotic manipulation, which uses a 3-D optical trap, videomicroscopy and machine vision software to identify, trap, and separate single particles with desirable properties. While the laser sorter is functionally equivalent to a flow sorter, the micromanipulator is a true microscopic robot that uses machine vision in order to navigate the optical trap and the trapped particle around unwanted cells. The robotic micromanipulator can be used to position the separated cells with 1 μm accuracy, and can set up microscopic experiments involving several selected cells. Thus, an optical trapping robotic manipulator can be used to analyze, separate and process cells and other microscopic biological particles.

45530 **Separation techniques used to prepare highly purified chromosome populations: Sedimentation, centrifugation, and flow sorting.** Albright, K.L. (Los Alamos National Lab., NM (USA)); Cram, L.S.; Martin, J.C. pp. 15, Paper I & EC 43 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

The Human Genome Project and the National Laboratory Gene Library Project are exciting applications of recombinant DNA technology. Supporting these programs is a technology base of Flow Cytometry and Molecular Biology. Flow cytometry analyzes heterogeneous chromosome suspensions and electronically separated desired chromosome types from undesired types, and collected them as a pure fraction. Adjunct techniques have been used to improve the efficiency of flow sorting. Prefractionation of the initial chromosome suspension has been carried out on sucrose and metrizamide gradients. Concentration of dilute suspensions has been done on a sucrose interface and on agarose plugs. The methods presented here are supported by the National Flow Cytometry Resource and the National Laboratory Gene Library Project.

45531 **New separation and detection schemes in gel electrophoresis.** Yeung, E.S. (Iowa State Univ., Ames (USA)). pp. 36, Paper I & EC 115 of American Chemical Society, Division of Industrial and Engineering Chemistry, Inc. American Chemical Society, Washington, DC (US) (1990). (CONF-900402–: 199. national meeting of the American Ceramic Society, Boston, MA (USA), 22-27 Apr 1990).

Gel electrophoresis for the separation of proteins and DNA fragments is widely used in biological research. Indirect fluorescence detection, where the analyte displaces a fluorescing ion in the running buffer, can be used for visualization without the use of radioactive or fluorescence tags on the analyte. This work for both slab gels and capillary gels. The authors also report the enhancement of separation of DNA fragments by using ultrasound excitation. The migration velocities increases and the bands become sharper. This new phenomenon provides yet another parameter for increasing selectivity in gel electrophoresis.

45532 **Use of Drosophila to study DNA repair.** Boyd, J.B, (California Univ., Davis, CA (USA)); Harris, P.V.; Sakaguchi, K. pp. 99-114 of DNA repair. Friedberg, E.C.; Hanawalt, P.C. Marcel Dekker Inc., New York, NY (USA) (1988).

This paper discusses Drosophila, the premier metazoan organism for analyzing many fundamental features of eukaryotic gene regulation. The authors present adaptations of several approaches for studying DNA repair to an analysis of repair-defective mutants in Drosophila. A current understanding of Drosophila DNA repair is described.

45533 **Use of Chinese hamster ovary cell mutants to study human DNA repair genes.** Thompson, L.H. (Lawrence Livermore National Lab., CA (USA)). pp. 115-132 of DNA repair. Friedberg, E.C.; Hanawalt, P.C. Marcel Dekker Inc., New York, NY (USA) (1988). DOE Contract W-7405-ENG-48.

This paper discusses the single-gene mutation approach to the field of DNA repair. The author focuses on a series of repair mutants of Chinese hamster ovary cells that provide a systematic way of characterizing human repair genes. Relevant methodologies are addressed.

45534 Immunological probes for lesions and repair patches in DNA. Leadon, S.A. (Lawrence Berkeley Lab., CA (USA)). pp. 311-326 of DNA repair. Friedberg, E.C.; Hanawalt, P.C. Marcel Dekker Inc., New York, NY (USA) (1988).

This paper describes two immunological approaches for the detection of DNA damage and its repair. The first uses a monoclonal antibody to directly measure the production and removal of one type of oxidized base, thymine glycol; the second uses an antibody to detect the repair synthesis event itself and, when combined with the use of molecular biological techniques, can be used to monitor the production and removal of lesions in specific sequences within the genome.

45535 Detection of closely opposed pyrimidine dimers as bifilar enzyme-sensitive sites. Reynolds, R.J. (Los Alamos National Lab., NM (USA)); Lam, L.H. pp. 427-442 of DNA repair. Friedberg, E.C.; Hanawalt, P.C. Marcel Dekker Inc., New York, NY (USA) (1988). Grant CA-33949.

This paper discusses the use of the sensitivity of UV-irradiated DNAs to cleavage by pyrimidine dimer (PD)-DNA alycosylases together with the specificity of this reaction to offer an opportunity to compare the induction and repair of DNA lesions at isolated and closely opposed positions in the DNA double helix. The authors address the use of nondenaturing conditions and the interpretation of the results of such use.

45536 In vitro suppression of an amber mutation by a chemically aminoacylated transfer RNA prepared by runoff transcription. Noren, C.J. (Univ. of California, Berkeley (USA)); Anthony-Cahill, S.J.; Suich, D.J.; Noren, K.A.; Griffith, M.C.; Schultz, P.G. *Nucleic Acids Research (UK),* 18(1): 83-88 (11 Jan 1990).

An amber suppressor tRNA was prepared in vitro by runoff transcription with T7 RNA polymerase. Both full-length tRNA and truncated tRNA lacking the 3′ terminal pCpA from the acceptor stem could be synthesized from the same DNA template. Truncated runoff suppressor tRNA could be enzymatically ligated to phenylalanyl-pCpA to generate aminoacylated full-length suppressor tRNA (Phe-$tRNA_{CUA}$). Phe-$tRNA_{CUA}$ is capable of suppressing an amber (UAG) mutation in vitro with equivalent efficiency as suppressor prepared by anticodon-loop replacement of a naturally-isolated tRNA. The ease of suppressor tRNA preparation using this method, compared to anticodon-loop replacement, greatly facilitates the use of chemically acylated suppressor tRNA's for site-specifically incorporating unnatural amino acids into proteins.

45537 Simple rapid method for gene transfer. Cockburn, A.F.; Meier, H. To Agricultural Research Service, Washington, DC. USA Patent Application 7-472,538. 30 Jan 1990. 11p. Source: NTISPC N03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The object of the present invention is to provide methods for gene transfer that reduce or eliminate cellular pretreatment steps, e.g., the removal of cell wall by chemical or enzymatic methods, is rapid and can be practiced without the need of additional expensive equipment. Cells, embryos or tissues selected for genetic manipulation are suspended in an Eppendorf tube in an aliquot of the desired genetic material to be transferred to which the resulting mixture is added and is agitated by vortexing from about 30 to about 90 seconds. The cells, embryos or tissue are sedimented and the DNA supernatant removed. After sedimentation, the injected material is resuspended in or on a growth medium to assay for expression.

5503 Cytology

45538 (DOE/ER/60437–5) **Electron microscope studies: Progress report, 1 July 1989–30 June 1990.** Crewe, A.V.; Kapp, O.H. Chicago Univ., IL (USA). Enrico Fermi Inst. 1 Aug 1990. 139p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60437. Order Number DE90015650. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

Our laboratory has made significant progress this year in devising improved electron-optical systems, in studying invertebrate hemoglobins with the STEM, and in achieving a workable sub-angstrom STEM. Our goal in electron optics is to improve resolution by producing spherical and chromatic aberration coefficients with signs opposite those of magnetic lenses. We have progressed toward this goal through calculations that explore the addition of electrodes to electron mirrors to reduce these two geometric aberrations and by devising a beam separation system that won't introduce asymmetrical aberrations. Some promising new designs of magnetic lenses for SEM applications have also been investigated. We have continued our exploration of the quaternary structure of the invertebrate hemoglobins and are now among the top laboratories in this area of expertise. In addition, we have overcome many of our electronic difficulties on the sub-angstrom STEM and have made significant progress toward achieving an operational system. The addition of an IBM RISC-6000 workstation to our lab has significantly increased our image processing capabilities.

45539 (LA-UR–90-2552) **Spatial localization of neural sources using the magnetoencephalogram.** Mosher, J.C. (University of Southern California, Los Angeles, CA (USA). Signal and Image Processing Inst.); Lewis, P.S.; Leahy, R. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9010156–1: 5. ASSP workshop on spectrum estimation and modeling, Rochester, NY (USA), 10-12 Oct 1990). Order Number DE90015056. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An array of Superconducting QUantum Interference Device (SQUID) biomagnetometers may be used to measure the spatio-temporal neuromagnetic field or magnetoencephalogram (MEG) produced by the brain in response to a given sensory stimulus. A popular model for the neural activity that produces these fields is a set of current dipoles. We assume that the location, orientation, and magnitude of the dipoles are unknown. We show how the problem may be decomposed into the estimation of the dipole locations using nonlinear minimization followed by linear estimation of the associated moment time series. The methods described are demonstrated in a simulated application to a three dipole problem. Cramer-Rao lower bounds are derived for the white Gaussian noise case. 8 refs., 2 figs., 1 tab.

45540 Lattice models of biological growth. Young, D.A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550 (USA)); Corey, E.M. *Physical Review, A (General Physics) (USA),* 41(12): 7024-7032 (15 Jun 1990). DOE Contract W-7405-ENG-48.

We show that very simple iterative rules for the growth of cells on a two-dimensional lattice can simulate biological-growth phenomena realistically. We discuss random cellular automata models for the growth of fern gametophytes, branching fungi, and leaves, and for shape transformations useful in the study of biological variation and evolution. Although there are interesting analogies between biological and physical growth processes, we stress the uniqueness of biological automata behavior. The computer growth algorithms that successfully mimic observed growth behavior may be helpful in determining the underlying biochemical mechanisms of growth regulation.

5504 Genetics

Refer also to citation(s) 45525, 45585

45541 (PNL-SA–16891) **State of the art address oncogenes and tumor-suppressing genes.** Frazier, M.E. Pacific Northwest Lab., Richland, WA (USA). May 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9005256–1: 7. annual veterinary medicine forum, San Diego, CA (USA), 25-28 May 1990). Order Number DE90015550. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Cancer has a myriad of causes but, whatever the cause, the changes that result in neoplasia are usually genetic. Although not all DNA damage results in cancer, evidence implicates two broad classes of genes in carcinogenesis. The first class, oncogenes are

genes that cause cancer. An oncogene results when there is increased and/or changed expression of the proto-oncogene. Oncogenes are dominant: when activated, they predominate over the activity of any normal alleles in the cell. Thus oncogenes act directly to cause cancer. The second class of genes associated with cancer are tumor-suppressing genes, which either code directly for, or control expression of a wide spectrum of tissue-specific differentiation antigens. Malignancy occurs in a specific cell type when expression of an appropriate tumor-suppressing gene is, homozygously, seriously distorted or completely lacking. Tumor suppressing genes also appear to regulate expression of a third, uncharacterized group of cancer-related genes that act in a recessive manner and are not expressed in the presence of the tumor-suppressing genes. We will first discuss oncogenes, then the tumor-suppressing genes. Experimental data will be used to illustrate key features of the carcinogenic process.

45542 (UCRL–102523) **X-ray holography for sequencing DNA.** Yorkey, T.; Brase, J.; Trebes, J.; Lane, S.; Gray, J. Lawrence Livermore National Lab., CA (USA). 26 Jun 1990. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–16: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015038. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we discuss the potential for application of x-ray holographic imaging techniques to the sequencing of DNA. We formulate an approximate model for the scattering of partially coherent x-rays from an oriented DNA fiber and show the feasibility of reconstruction of heavy atom label positions from the x-ray scattering data. A series of simulations has been done to demonstrate the required reconstruction algorithms. An x-ray experiment is currently in progress to demonstrate the real feasibility of the technique. 5 refs., 14 figs.

45543 Orchestrating the human genome project. Cantor, C.R. (Lawrence Berkeley Lab., CA (USA)). *Science (Washington, D.C.) (USA),* 248(4951): 49-51 (6 Apr 1990). DOE Contract AC03-76SF00098.

The Human Genome Project is under way. The Department of Energy and the National Institutes of Health are cooperating effectively to develop organizational structures and scientific priorities that should keep the project on schedule and within its budget.

45544 Molecular evolution of the small subunit of ribulose bisphosphate carboxylase: Nucleotide substitution and gene conversion. Meagher, R.B. (Univ. of Georgia, Athens (USA)); Berry-Lowe, S.; Rice, K. *Genetics (USA),* 123(4): 845-863 (Dec 1989). DOE Contract FG09-86ER13543.

The nucleotide sequences encoding the mature portion of 31 ribulose 1,5-bisphosphate carboxylase small subunit (SSU) genes from 17 genera of plants, green algae and cyanobacteria were examined. Among the 465 pairwise sequence comparisons, SSU multigene family members within the same species were more similar to each other in nonsynonymous or replacement nucleotide substitutions (RNS) than they were to SSU sequences in any other organism. The concerted evolution of independent SSU gene lineages within closely related plant species suggests that homogenization of RNS positions has occurred at least once in the life of each genus. The data suggest that mature SSU sequences do not accumulate more than 20% differences in the RNS positions without compensatory changes in other components of this enzyme system. A mechanism involving gene conversion within the exons followed by selection for biased gene conversion products with conservation within the exons followed by selection for biased gene conversion products with conservation of RNS positions and divergence of SNS positions is discussed. A SSU gene tree based on corrected RNS for 31 SSU sequences is presented and agrees well with a species tree based on morphological and cytogenetic traits for the 17 genera examined.

45545 The anonymous probe pR1-4 which identifies the locus D13S59 detects a BanII RFLP. Bowcock, A.M. (Stanford Univ., CA (USA)); Hebert, J. *Nucleic Acids Research (UK),* 17(20): 8396 (25 Oct 1989).

Probe pR1-4 contains a 6.7kb fragment from bacteriophage 13.1 which was subcloned into the HindIII site of PBR322. Cleavage of pR1-4 with HindIII/PstI generates a 2.7kb fragment that can be used as a single copy probe on Southern blots. Phage 13.1 was isolated from a chromosome 13 specific library constructed in Charon 21A. BanII (GPuGCPy/C) detects a two allele polymorphism with fragment lengths of 8.5kb (A1) and 4.9kb (A2). The frequency was estimated from 156 unrelated Caucasoids. It was localized to chromosome 13 on the basis of linkage with other loci/genes including ESD and RB1, known to reside on this chromosome. Co-dominant segregation was observed in 35 families (474 individuals).

45546 The anonymous probe pF5A identifying the locus D13S61 detects RFLPs with XmnI and BanII. Bowcock, A.M. (Stanford Univ., CA (USA)); Hebert, J.M. *Nucleic Acids Research (UK),* 17(20): 8397 (25 Oct 1989).

Probe pF5a contains a 4.0kb fragment from phage 13.F1 which was subcloned into the HindIII site of pBR322. Phage 13.F1 was isolated from a chromosome 13 specific library constructed in Charon 21A. BanII (GPuGCPy/C) detected a two allele polymorphism with fragment lengths of 5.4kb and 5.2kb and a constant band of 4.5kb. XmnI (GAANN/NNTTC) detected a two allele polymorphism with fragments of 8.0kb and 7.5kb. It was localized to chromosome 13 on the basis of two point linkage with loci known to be located on this chromosome. Co-dominant segregation was observed in 7 families (79 individuals).

5505 Metabolism

Refer also to citation(s) 44943

45547 (INIS-mf–12093) **The effects of human thyropexin (hTBG) and human prealbumin (hTBPA) on the thyroxine metabolism in the rabbit.** Fessler, E. Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet. 1983. 73p. (In German). Order Number DE90706126. Source: NTIS (US Sales Only), PC A04/MF A01 - OSTI.

Rabbits received sub-threshold single doses of 20-30 μCi of $^{125/131}$I-thyroxine T_4 by intravenous injection. About 16 hours later, each experimental group of animals received either human thyropexin (hTBG), human pre-albumin (hTBPA), or human serum albumin (hSA) in different quantities. The backflow of the injected tracer T_4 into the blood stream was determined by measuring the overall radioactivity and the precipitate radioactivity in the serum.

5506 Medicine

Refer also to citation(s) 44357, 44951, 45527, 45584, 45598, 45603, 45627, 45912, 46052

45548 (BNL–44037) **[NMR and PET imaging]: Foreign trip report, May 21, 1988–May 30, 1988.** Fowler, J.S. Brookhaven National Lab., Upton, NY (USA). 31 May 1988. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015214. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of the Sigrid Juselium Symposium was to address the fundamental chemical and biological principles common to NMR and PET imaging. Presentations addressed NMR imaging and the problems in contrast agent development and the fundamental differences and strengths of PET and NMR in medical research and clinical practice. New developments on radiotracers from the standpoint of synthesis and in vivo study were presented including metabolic tracers, labeled antibodies and labeled receptor active compounds and drugs. Pitfalls in data analysis and interpretation were also covered. The Nordic Synposium specifically addressed the application of PET to problems in a cardiology and included descriptions of PET studies as well as the basic biochemistry which takes place in the normal and diseased myocardium. All lectures at both meetings were by invitation.

45549 (DOE/ER/60870–1) **^{89}Zr chelates for antibody labelling: Annual report, July 15, 1989–July 14, 1990.** Ali, S.; Shankland, E. Washington Univ., Seattle, WA (USA). [1990]. 22p.

Sponsored by U.S. DOE Energy Research. DOE Contract FG06-89ER60870. Order Number DE90016192. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As a stated in the original grant, the overall goal of this project was to develop the radiochemistry of a positron emitting nuclide of several days half-life to be used to label proteins and monoclonal antibodies (MAbs). Specifically, the objective of this proposal was the development of target and radiochemical techniques to radiolabel MAbs with ^{89}Zr. The immediate specific aims were: (1) to develop the chemistry and radiochemistry of zirconium, including its separation after bombardment of yttrium, (2) to formulate chemical syntheses to be applied to a high specific activity zirconium product, with the goal of providing a zirconium chelate stable in vivo conditions. Ligands will be synthesized and characterized for ability to attach zirconium to proteins, beginning with serum albumin as a model protein, (3) to evaluate protein labeling chemistry developed in Aim 2 with application to monoclonal antibodies. All proteins, including antibodies, provide numerous possible binding sites. The effect on the antibody of chemical derivatization with the zirconium and its ligand will be studied, and (4) to provide enough new and novel zirconium chemistry and radiochemistry from these results to revise and update the NAS/NRC monograph on zirconium.

45550 (INIS-mf–12092) **CT examination after intrathecal or intraventricular application of metrizamide in 110 patients for neurosurgery.** Krakow, D. Ulm Univ. (Germany, F.R.). Fakultaet fuer Klinische Medizin. 24 Jun 1983. 107p. (In German). Order Number DE90706125. Source: NTIS (US Sales Only), PC A06/MF A01 - OSTI.

The CT scans were done in 110 patients for examination of the liquor carrying cerebral brain compartments, especially the cisterns after intrathecal application of the radiopaque medium metrizamide. The properties of the medium are explained in detail.

45551 (INIS-mf–12103) **The value of computerized tomography and sonography in different types of pancreatitis, judged on the basis of a diagnosis previously confirmed by retrograde endoscopic cholangiopancreaticography and the pancreomycin-secretin test.** Sewing, G. Koeln Univ. (Germany, F.R.). Medizinische Fakultaet. 21 Nov 1985. 122p. (In German). Order Number DE90706128. Source: NTIS (US Sales Only), PC A06/MF A01 - OSTI.

The blind study described here pointed to a superiority of computered tomography, the results of which in chronic pancreatitis were judged to be better than those of sonography, chiefly because of its high sensitivity in the detection of calcified deposits in the pancreas. The values determined, in particular those relating to the specifity of the methods used, were lower than the data given by other authors. From the findings revealed here there was, however, sufficient evidence to confirm that both computered tomography and sonography certainly have their merits as non-invasive methods of morphological examination in the diagnosis of pancreatitis. They should therefore be used, preferably in combined form, prior to any other diagnostic measures that may be more hazardous to the patient

45552 (INIS-mf–12104) **The desmoid tumour: Therapeutic results of surgical intervention as compared to those achieved with radiotherapy.** Weindler, J. Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). 7 Feb 1983. 71p. (In German). Order Number DE90706129. Source: NTIS (US Sales Only), PC A04/MF A01 - OSTI.

Discussion of the case reports of nine patients treated for desmoid tumours in the light of 62 such cases described in the relevant literature between 1975 and 1979. Among the patients analysed for the purposes of this study 9 had desmoid tumors treated at our clinic, while the other 60 cases were described in the relevant literature of the past 5 years. The methods used in this cohort were surgery for 37 patients, radiation for 20 patients, excision and post-surgical radiation for 5 patients and various other treatments for the remaining cases. Careful analysis and assessment of the results led to the conclusion that the vast majority of desmoids can be expected to show a satisfactory response to radiation, even though no clear therapeutic superiority could be established for either radical excision or radiation. If surgery is chosen, this should be carried out with the aim of removing all of the tumour. In circumstances precluding radical excision it appears wise to use post-surgical radiation. Follow-up examinations should be carried out in all patients so as to permit immediate diagnosis and treatment of any recurrent tumours. Each desmoid tumour is to be treated on an individual basis. In small tumours it is safer to remove not only the lesion itself but also some of the surrounding intact tissue, tumours at a more advanced stage should be subjected to radiation or both surgery and subsequent radiotherapy.

45553 (INIS-mf–12106) **The use of computerized tomography in patients showing tardive dyskinesia.** Themelis, I. Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet. 1983. 43p. (In German). Order Number DE90706130. Source: NTIS (US Sales Only), PC A03/MF A01 - OSTI.

29 patients showing moderate to markedly pronounced tardive dyskinesia (TD) and a future 29 control patients (C) under a similar long-term medication with neuroleptics that had been so chosen as to match the age and sex distributions of the former group were subjected to computered tomography, neurological examination and phychological testing. The results did not point to any correlations between the structural changes and duration of treatment and the clinical signs or symptoms of extrapyramidal disorder. This was taken as futher evidence in support of the theory that the initial damage in tardive dyskinesia mainly is at the level of the basal ganglia.

45554 (ORNL/TM–11570) **Nuclear Medicine Program progress report for quarter ending June 30, 1990.** Knapp, F.F. Jr.; Ambrose, K.R.; Callahan, A.P.; McPherson, D.W.; Mirzadeh, S.; Srivastava, P.C.; Allred, J.F.; Hasan, A.; Lambert, C.R.; Lambert, S.J.; Rice, D.E. Oak Ridge National Lab., TN (USA). Aug 1990. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016681. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this a report novel electrochemical method is described for the separation of copper-64 and copper-67 following the irradiation of zinc targets. This method is based on the spontaneous electrodeposition of copper on a platinum electrode immersed in the zinc target solution without requiring an external electromotive force (EMF). No-carrier-added N-[2-(3-[^{125}I]iodo-4-hydroxyphenyl)ethyl]-maleimide has been prepared by direct iodination of N-[2-(4-hydroxyphenyl)ethyl]-maleimide with (Na[^{125}I]-chloramine-T). The precursor was prepared by condensation of tyramine with maleic anhydride followed by ring annulation. Studies in rats showed low thyroid uptake of radioactivity which reached a plateau after 4 h, indicating in vivo stability. This new radioiodinated maleimide analogue reacts with bovine serum albumin (BSA) under mild conditions and has been used for labeling a lung-endothelial-cell-specific antibody (411-201B). The [^{125}I]-labeled antibodies are currently being evaluated for immunoreactivity and tumor specificity. During this period several agents were also supplied to Medical Cooperative investigators, including iodine-123-labeled and iodine-131-labeled fatty acid analogues for studies at the Brookhaven National Laboratory, the Cardiology Department at the Free University of Amsterdam, and the University of Bonn, West Germany. A tungsten-188/rhenium-188 generator was supplied to the University of Massachusetts, and osmium-191 was supplied for fabrication of generators for patient studies in Finland. 4 refs., 5 figs., 5 tabs.

5507 Microbiology

Refer also to citation(s) 43852, 44076, 44088, 45520, 45521

45555 (EUR–12439) **Basic studies on adhesion of anaerobic micro-organisms to inert carriers: Final report.** Camilli, M. (Eniricerche SpA, Monterotondo (Italy)). Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation; Eniricerche SpA, Monterotondo (Italy). 1989. 75p. Sponsored by Commission of the European Communities. Contract EN-3B-0051-1. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, ru Mercier L-2985 Luxembourg.

The main purpose of this project was to study the microbial adhesion on an inert carrier, specifically in bench-scale and pre-pilot

fluidized-bed anaerobic reactors. Many porous and nonporous granular materials (activated carbon, lake sand, coke, pumice stone, fossil flour, silica gel, glass powder, cationic resins, pit-coal) were studied in bench-scale continuous stirred tank reactors (CSTR) in order to select appropriate microbial carriers for anaerobic fluidized bed reactors. Lake sand was used in bench-scale anaerobic fluidized bed reactor experiments to investigate the biofilm development kinetics, and the biomass and reactor yields under increasing organic loading conditions, with a synthetic medium as feed. Biolayer thickness, its distribution along the fluidized bed, biomass weight/cm^2 carrier surface and biomass dry density were evaluated using statistical analysis. 16 refs., 9 figs., 7 tabs.

5508 Morphology

45556 (DOE/DP/10782–1) **Soft x-ray contact imaging of biological specimens using a laser-produced plasma as an x-ray source: Final report.** Cheng, P.C. State Univ. of New York, Buffalo, NY (USA). Dept. of Electrical and Computer Engineering. [1990]. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AS03-88DP10782. Order Number DE90016098. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of a laser-produced plasma as an x-ray source provides significant advantages over other types of sources for x-ray microradiography of, particularly, living biological specimens. The pulsed nature of the x-rays enables imaging of the specimen in a living state, and the small source size minimizes penumbral blurring. This makes it possible to make an exposure close to the source, thereby increasing the x-ray intensity. In this article, we will demonstrate the applications of x-ray contact microradiography in structural and developmental botany such as the localization of silica deposition and the floral morphologenesis of maize.

5509 Pathology

Refer also to citation(s) 43779, 43781, 45541

45557 (PNL-SA–15749) **Child-rearing and adult leukemia: Epidemiologic evidence in support of competing hematopoietic stem cell differentiation.** Steven, R.G. (Pacific Northwest Lab., Richland, WA (USA)); Severson, R.K.; Heuser, L. Pacific Northwest Lab., Richland, WA (USA). May 1988. 14p. Sponsored by U.S. DOE Energy Research; New York State Power Lines Project. DOE Contract AC06-76RL01830. Order Number DE90016297. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The hypothesis that lack of child-rearing increases the risk of acute non-lymphocytic leukemia (ANLL) in adults was examined in a case-control study in western Washington State. Among 159 study subjects over age 50 in 1985, there were 76 cases of ANLL and 83 controls. The crude odds ratio associated with lack of child-rearing was 1.8, with a 95% confidence range of 0.7 to 5.0. The average total number of children ever living with cases was 2.6 and with controls was 3.1 ($p = 0.06$). The mean total number of years living with a child, or children, under age 18 was 17.6 in cases and 20.2 in controls ($p = 0.05$). These results were not materially altered after adjustment for age, smoking, race, income, and sex. The data provide evidence that cases of ANLL were less likely to ever have had children and that fewer years were spent rearing children than were spent by controls. The hypothesis was based on the "competing stem cell" theory of hematopoietic ontogeny. If valid, then exposure to children would increase exposure to infection, leading to increased lymphocytic stem cell turnover, and decreased non-lymphocytic stem cell turnover. This, in turn, may reduce risk of ANLL in adults. 18 refs., 3 tabs.

5510 Physiological Systems

45558 The effect of electrical coupling on the frequency of model neuronal oscillators. Kepler, T.B. (Brandeis Univ., Waltham, MA (USA)); Marder, E.; Abbott, L.F. *Science (Washington, D.C.) (USA)*, 248(4951): 83-85 (6 Apr 1990).

Neurons with oscillatory properties are a common feature of the nervous system, but little is known about how neural oscillators shape the behavior of neuronal networks or how network interactions influence the properties of neural oscillators. Mathematical models are used to examine the effect of electrically coupling an oscillatory neutron to a second neuron that is either silent or tonically firing. Models of oscillatory neurons with varying degrees of complexity show that this coupling can either increase or decrease the frequency of an oscillator, depending on its membrane potential wave form, the state of the neuron to which it is coupled, and the strength of the coupling. Thus, electrical coupling provides a flexible mechanism for modifying the behavior of an oscillatory neural network.

5530 Agriculture and Food Technology

Refer also to citation(s) 45612

45559 (IAEA-TECDOC–554, pp. 7-15) **Radiotracer studies of maneb and ethylenethiourea in tomato fruits and in soils.** Musumeci, M.R. (Biological Inst., Sao Paulo (Brazil). Radioisotope Center); Barros Ostiz, S. de; Bonanho, T.; Silva, M.C.D.; Flores Ruegg, E. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Maneb and ETU residues were studied on tomatoes after 4 field sprayings with ^{14}C-maneb. The residue declined with time; 14 days after the last application, fruits had 3.0 μg/g of maneb and 0.03 μg/g of ETU. On ripe fruits, maneb concentration was 0.6 μg/g, but no ETU was detected. In tomatoes with a single ^{14}C-maneb spray, the radiocarbon was associated mainly with the fruit skin; 1.2% were detected in pulp and no activity in seeds. Washing fruits decreased ETU content, but cooking increased ETU levels substantially. In fruits treated with one application of ^{14}C-ETU, the half-life was 5.7 days with ethyleneurea and ethylenediamine as major degradation products. In soil treated with ^{14}C-maneb or ^{14}C-ETU, ^{14}C-labelled residues disappeared fairly rapidly. ^{14}C-ETU in soil had a half-life of less than 4 weeks. In soil, most of the radioactivity derived from ^{14}C-maneb or ^{14}C-ETU was found in the top 5 cm layer. Methanol non-extractable activity was substantial in soils treated with ^{14}C-maneb or ^{14}C-ETU. When soil samples were incubated with ^{14}C-ETU under laboratory conditions, mineralization occurred and $^{14}CO_2$ evolved contributed 27-42% of the initial radioactivity after 35 days. (author). 9 refs, 5 tabs.

45560 (IAEA-TECDOC–554, pp. 17-24) **Radiotracer studies of maneb residues in tomato plants.** Pazmino, O. (Ministry of Agriculture and Livestock, Quito (Ecuador)); Bolanos, M.; Espinosa, L.; Moran, M.; Molineros, J.; Merino, R. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Maneb concentrations in commercial preparations showed no apparent significant decreases over a period of 19 weeks while ethylenethiourea showed slight increases from 260 to 420 ppm over the same period. A study on the fate of ^{14}C-maneb and ^{14}C-ETU in tomato plants under greenhouse conditions showed that ETU residues in leaves increased to a maximum of 1.37 ppm 56 days after the last application and slowly declined to 0.2 ppb 4 months after the last application. The fruits showed ETU residues of 1.12 ppm after 56 days following the last application and decreased to undetectable levels after 4 months. Cooking of fruits resulted in a decrease of extractable ^{14}C-activity while ETU concentration in the extract increased from 31 to 50%. (author). 5 refs, 7 tabs.

45561 (IAEA-TECDOC–554, pp. 25-29) **Residues of maneb in tomato and their persistence during cooking and storage.**

Kolankaya, D. (Hacettepe Univ., Ankara (Turkey). Faculty of Science); Oegues, A.; Ayas, Z.; Akay, M.T. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Tomato plants, grown in greenhouse were sprayed with an aqueous suspension of ETU-free ^{14}C-maneb (5 mg/10 μCi/plant) three times at weekly intervals. Thirty-five days after the first application, maneb residues were highest in leaves (352 ppm) and lowest in fruits (0.12 ppm). ETU values were generally low and the fruit concentration was 0.01 ppm. It is noted that ETU residues were only those generated in 35 days from ETU-free maneb. Cooking fruits reduced maneb concentration by 27% and increased ETU from 0.010 to 0.014 ppm. Analysis of commercial preparations of maneb over a period of 18 months showed a decline of maneb concentration by 10% and 40% in closed and open packages, respectively. (author). 10 refs, 3 tabs.

45562 (IAEA-TECDOC–554, pp. 31-40) **Ethylenethiourea (ETU) and ethylenethiuram monosulfide (ETM) in bean plants treated with ^{14}C-maneb.** Harhash, A.H.E. (Cairo Univ., Cairo (Egypt). Chemistry Dept.); Hegazi, B.; Zayed, S.M.A.D. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

The fate and magnitude of residues of maneb in bean plant (Vicia faba) were determined following fungicidal applications under conditions of local practice. ^{14}C-maneb, diluted with ETU-free cold maneb to a final specific activity of 2 mCi/g was applied three times at weekly intervals. The total dose amounted to 12.23 mg/plant (25.76 μCi). Residues were extracted with chloroform-ethanol, water, EDTA and the unextractable residues were determined by combustion. Transformation products were identified and quantified by TLC. The data indicated that < 3% of the applied dose was found in the different parts of the plant. Chloroform-ethanol and water extractable residues showed a gradual increase in leaves, stem and roots of the plant. ETM appeared in water extracts of both leaves and stem. ETU was detected in both chloroform-ethanol and water extracts of leaves and stem 25 days after the first treatment. ETU and ETM were major metabolites in the dry seeds which showed a residue concentration of 0.05 ppm of which only 6% was water and chloroform-ethanol extractable. ETU contributed 25% of the extractable products. The bound material remained unidentified. (author). 7 refs, 1 fig., 8 tabs.

45563 (IAEA-TECDOC–554, pp. 41-48) **Fate of ^{14}C-maneb in soyabean plants.** Harhash, A.H.E. (Cairo Univ., Cairo (Egypt). Chemistry Dept.); Zayed, S.M.A.D.; Hegazi, B. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. Contract IAEA-R-3735. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Seeds of soyabean were cultivated under normal field conditions in June 1988. ^{14}C-maneb, diluted with ETU-free cold maneb to a final specific activity of 2 mCi/g, was applied three times at weekly intervals with a total dose of 6.45 mg maneb/plant. Different parts of plant samples, collected at different intervals, were extracted with ethanol-chloroform, ethylene diamine tetracetate and water. The overall data indicated that no more than 5% of the applied dose was detected on/in the plant. Residues in leaves and stem showed a gradual increase of both chloroform and water extracts. Analysis of residues in these extracts showed that ETU and ETM were significant transformation products in addition to two major unknown compounds. The concentration of ETU in both extracts from the leaf increased from 0.0105 ppm after 26 days to 0.163 ppm after 76 days. In stem, ETU increased from 0.007 ppm to 0.110 ppm for the same period. Total residues in seeds declined from 0.074 ppm after 40 days to 0.037 ppm after 76 days. Almost half of these residues was methanol-unextractable. The major part of extractable residues in seeds was hydrophobic in nature and characterized in the extracted soyabean oil as ETU, ETM and two unknowns. ETU in oil increased from 2 ppb after 40 days to 7 ppb after 76 days following the first treatment. (author). 7 refs, 7 tabs, 1 scheme.

45564 (IAEA-TECDOC–554, pp. 49-53) **Degradation of maneb to ethylenethiourea in large pepper.** Ramon, F (Panama Univ., Panama City (Panama). Centro de Investigaciones con Tecnicas Nucleares); Espinosa, J.; Batista, A.; Archibold, W. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Large pepper was field cultivated and sprayed three times with ^{14}C-maneb at weekly intervals. Samples of fruits were collected after each application and samples of leaves and stems were collected 1-2 days and 1-2-3-4 weeks after the last application. Appreciable quantities of maneb and maneb-derived residues were found in stems, leaves and fruits. The latter contained only trace quantities of ETU, which are unlikely to present any hazard to consumers. (author). 2 refs, 4 tabs.

45565 (IAEA-TECDOC–554, pp. 55-59) **Radiotracer study of mancozeb residues in tomato plants.** Zhang Lianzhong (Academia Sinica, Beijing (China). Research Centre for Eco-Environmental Sciences); Mo Hanhong; Wang Huafang. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

A study of the persistence and residue distribution of mancozeb in tomato plant-soil system was conducted using radiotracer techniques. Half-life values for total mancozeb residues on tomato leaves and in soil were found to be 9.5 and 7.6 days, respectively. Mancozeb residues in soil were readily taken up by plants and leached to soil layers as deep as 28 cm within two weeks with over 90% of the residues remaining in the 0-6 cm layer. Translocation of mancozeb residues, especially water soluble metabolites including ETU, throughout the plants could be a major factor responsible for the presence of residues in tomato fruits. Deposits of sprayed mancozeb on the fruit skin was another important factor. Fruit skin contained higher levels of residues than the pulp. Washing with water could remove more than 50% of the residues on the skin. It was also found that 20 - 30% of the residual mancozeb degraded to ETU during cooking resulting in a highly significant increase of ETU content in the fruit. (author). 5 refs, 3 tabs.

45566 (IAEA-TECDOC–554, pp. 61-72) **Residues of mancozeb and ethylenethiourea in cucumber treated with ^{14}C-mancozeb under field conditions.** Calumpang, S.M.F. (University of the Philippines at Los Banos, Laguna (Philippines). Pesticide Toxicology and Chemistry Lab.); Barredo, M.J.V.; Magallona, E.D.; Roxas, N.P. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Potted cucumber plants sprayed four times with ^{14}C-mancozeb ETU-free Dithane M-45 were exposed to field conditions. At harvest, only the leaves and stem contained mancozeb. Ethylenethiourea (ETU), 0.26 μg/g, was found in the leaves only. ETU in the stem, fruit or soil could not be detected by high pressure liquid chromatography. These results were confirmed by radiotracer techniques. Washing of fruits reduced radiocarbon levels by 46%. Peeling practically removed all the radiocarbon, while boiling in water and vinegar (pickling) also reduced these levels in the fruit by 64 and 67%, respectively. ETU levels found in commercial formulations rose rapidly and reached a peak after 2.4 months before declining. An initial concentration of 440 μg/g in sealed packages increased to 2450 ppm after 10 weeks and declined to 450 μg/g after 70 weeks. In open packages, ETU substantially declined to 30 μg/g after 70 weeks. (author). 20 refs, 2 figs, 5 tabs.

45567 (IAEA-TECDOC–554, pp. 73-78) **Residues of mancozeb and ethylenethiourea in beans.** Musumeci, M.R. (Biological Inst., Sao Paulo (Brazil). Radioisotope Center); Silva, M.C.D.; Flores Ruegg, E.; Rolim, P. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Mancozeb and ethylenethiourea (ETU) residues were determined in bean plants after 5 field sprays with ^{14}C-mancozeb at 12-day intervals. The highest residues were found on leaves. After 14 days from last application, mancozeb residues declined to 10 μg/g from 79 μg/g of the 0-day sample. Mancozeb concentration in pods was 2.5 μg/g, while ETU in pods at the sampling time was 0.15 μg/g. Baking of homogenized pods resulted in partial mancozeb conversion to ethylenethiourea, corresponding to a net increase of 25% of ETU. Only 0.5% of the radiocarbon detected on 0-day was found in seeds at harvest, 35 days after last spray. Seed extracts were ETU-free. (author). 7 refs, 4 tabs.

45568 (IAEA-TECDOC–554, pp. 79-84) **Mancozeb residues in tomato plants.** Ramli, J. bin (Agricultural Univ. of Malaysia, Selangor (Malaysia). Dept. of Biochemistry and Microbiology); Arshad, J.H.B.; Ismail, M. bin; Abdul Wahib, S. bin. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Three different samples of commercial formulations were analysed for ETU during a storage period of 6 months. Depending on storage conditions and the source of the formulation, ETU in the mancozeb formulation increased after 6 months by 70 to 180%; ETU in the maneb formulation increased from 0.035% to 0.045 - 0.080%. When ^{14}C-mancozeb was sprayed on plants and field weathered under conditions of local practice, ETU concentration in fruit was 16.8 ppm after 4 weeks. These values are considered extremely high. When ^{14}C-ETU was applied directly on fruits and field weathered, the percentage remaining after 4 weeks was 1.43% of the total applied. Washing and cooking removed more than 50% of ETU residues in the fruits. (author). 9 refs, 2 tabs.

45569 (IAEA-TECDOC–554, pp. 85-91) **Persistence and metabolism of mancozeb in brinjal (egg plant).** Agarwal, H.C. (Delhi Univ. (India). Dept. of Zoology); Kumar, U. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Brinjal (Solanum melongema) or egg plants in flowering and fruiting stage were sprayed with ETU-free formulation containing 45 mg mancozeb and 9.71 μCi ^{14}C-mancozeb per plant. Spraying was repeated twice every 7th day. Leaves, stem, fruits and roots were collected and extracted with chloroform-methanol and the metabolites identified and quantified by TLC. The parent fungicide was determined by CS_2-method and radiocounting. More than 90% of mancozeb residues were detected in the leaves, while the fruits contained only about 2%. Two weeks after the last treatment, the fruits contained 21 ppm mancozeb which declined to 4 ppm 1 week later. The half-life of mancozeb was 8.6 days on fruits and 9.5 days on leaves. Four products, EU, ETU, ETD and ETM were found generally in all samples. Five more unknown products were detected but they accounted for a very small proportion of the residues. EU was the major metabolite and its concentration was about 1.3 ppm in the fruits 2 weeks after the final spray. ETU accounted for 0.12 ppm at that time. In storage, commercial formulations of mancozeb decomposed by 25% after 390 days. (author). 16 refs, 4 tabs.

45570 (IAEA-TECDOC–554, pp. 93-96) **Effect of washing, baking and cooking on aged residues of mancozeb in brinjals (egg plants).** Agarwal, H.C. (Delhi Univ. (India). Dept. of Zoology); Kumar, U. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Twelve brinjal fruits (unplucked) were treated each with 0.5 ml aqueous suspension of ETU-free ^{14}C-mancozeb containing 1.81 mg mancozeb/1.09 μCi. The fruits were plucked 15 days later and subjected to washing, baking or cooking. The unwashed brinjals contained about 4.8 ppm of mancozeb residues showing a loss of about 70% of the initially applied mancozeb. Washing of the fruits reduced the residues further to about 0.8 ppm and baking led to a further reduction. Boiling the fruits in water gave similar results in terms of residue losses. TLC revealed the presence of trace amounts of ETM and ETD. ETU (and possibly EU) was the major degradation product. (author). 5 refs, 2 tabs.

45571 (IAEA-TECDOC–554, pp. 97-101) **Radiotracer study of zineb residues in egg plant-soil systems.** Zhang Lianzhong (Academia Sinica, Beijing, BJ (China). Research Centre for Eco-Environmental Sciences); Wang Guangshun; Mo Hanhong; An Fengchun; Qian Jianguo. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

In view of the widespread use of zineb on food plants and the toxicity of one of its metabolites, ethylenethiourea (ETU), a study of this agrofungicide in plant-soil systems was conducted. The half-life values for total zineb residues on egg-plant leaves and in soil were calculated to be 22.4 and 16.0 days, respectively. Egg-plant skin contained higher amounts of zineb residues than the fruit pulp. Washing with water could greatly reduce zineb residue levels, present on the fruit skin. Compared with zineb, ETU is much easier to be taken up by the egg-plant and to leach into deeper layers of soil due to its water solubility. In soil-plant studies using artemisia plant, the uptake from soil did not exceed 3% zineb and 5% ETU after 3 weeks. (author). 4 refs, 5 tabs.

45572 (IAEA-TECDOC–554, pp. 103) **Persistence of ^{14}C-ethylenethiourea in brinjal plants and soil.** Agarwal, H.C. (Delhi Univ. (India). Dept. of Zoology); Kumar, U.; Singh, D.K. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.*

Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

^{14}C-ethylenethiourea, ETU, (8.6mg) applied to 12 leaves on the plant dissipated quickly to 28% after 3 days. After 4 weeks, the treated leaves contained only 0.25%. Residues in all fruits were only 0.47 μg after 3 days, increasing to 3.31 μg after 2 weeks and declining to 0.69 μg after 8 weeks. Ethyleneurea (EU) was undetectable in fruits after 3 days. Seven-day samples contained 1.0 μg, increasing to 3.15 μg after 2 weeks and declining to 1.2 μg after 8 weeks. The persistence and leaching of ^{14}C-ETU was studied in soil-filled PVC columns under irrigated and non-irrigated conditions. Each column was treated with 3.27 mg ETU/1.365 μCi in 10 ml water and radioactivity was determined for various depths over a period of 52 days. Under non-irrigated and irrigated conditions, the major ^{14}C-activity was retained in the top 10 cm of soil with only < 2% and < 4% leaching to lower depths, respectively. In the absence of moisture, soil contained 75% of the applied ETU after 22 days. In irrigated soils, 54% was found in soil after 25 days; this declined to 30% after 52 days. (author).

45573 (IAEA-TECDOC–554, pp. 105-106) **Studies of ^{14}C-mancozeb fungicide and ^{14}C-ethylenethiourea in silty clay loam soil.** Calumpang, S.M.F. (University of the Philippines at Los Banos, Laguna (Philippines). Pesticide Toxicology and Chemistry Lab.); Barredo, M.J.V.; Magallona, E.D.; Roxas, N.P. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Published in summary form only. 4 refs. DEDTC/fungicides; FUNGICIDES/loam; FUNGICIDES/silt; CARBON 14 COMPOUNDS; CLAYS; DECOMPOSITION; DEDTC; FUNGICIDES; LOAM; SILT; MANGANESE COMPOUNDS; THIOUREAS

45574 (IAEA-TECDOC–554, pp. 107-110) **An attempt to separate ethylenethiourea and ethyleneurea, degradation products of ethylenebis(dithiocarbamates), using HPLC.** Moza, P.N. (Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Oekologische Chemie); Hustert, K. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). In *Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.* Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Ethylenethiourea (ETU) and ethyleneurea (EU) are the primary biotic and abiotic degradation products of ethylenebis(dithiocarbamate) fungicides. The analytical methods used for identification and quantification of ETU involve extraction, clean-up and derivatization. The derivatization methods do not give quantitative recoveries. In recent years, HPLC has been extensively used for analysis of polar compounds and this technique has been tried to determine the chemicals in water and soil. The limit of detection of ETU/EU was shown to be 0.1 ppm using a silica gel or chemically modified silica gel as a stationary phase and a UV detector. None of the HPLC columns like silica gel, RP-18 reverse phase, Nucleosil (CN) or cyclobond using different eluting solvent mixtures could effect satisfactory separation of ETU and EU in water or soil extracts. Because of their close structural resemblance, HPLC-based methods tested in this research have failed to satisfactorily separate the two chemicals. (author). 12 refs, 2 figs, 1 tab.

45575 (INIS-mf–12684) **Effect of different gamma sterilizing doses on the fertility and progeny production of pulse beetle (callosobruchus maculatus).** Khattak, S.U. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 4p. Order Number DE90636777. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The effect of gamma radiation doses on fertility and progeny production of c. maculatus was studied and sexed adults were exposed to various radiation doses. After irradiation, six pairs replicates were selected from each radiation dose and released into 5g mungbeans. The results showed that fertility was improved upto 41% in females from male irradiated and 86% in females from female irradiated. The improvement and fertility was upto 52% and 80% at 2.5 Krad when the irradiated parents were male and female respectively. The genetic damage in subsequent generation was higher in progney process of irradiated parent male. (A.B.).

45576 (INIS-mf–12685) **Effect of different radiation doses on pupae of cabbage butterfly, (pieris brassicae).** Sattar, A.; Khattak, S.U. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 2p. Order Number DE90636778. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The lots of 12 pupae, 3-2 days old, were irradiated at different radiation doses for each treatment. There was no emergence at 40 Krad showing that this dose was the lethal dose for the pupae of this insects. There was a significant reduction in adult emergence below this dose. (A.B.).

45577 (INIS-mf–12686) **Irradiation preservation of onions on commercial scale.** Khan, I.; Sattar, M.; Wahid, M.; Ahmad, A.; Jan, M. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 4p. Order Number DE90636779. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The present studies were initiated to reduced the post-harvest losses and extend the storage life of onions by sproupt inhibiting dose (10 Krad) of gamma irradiation on commercial scale during storage at ambient conditions under the shade. The post-irradiation research studies were conducted in a specially designed onion-shed and under the shade of for the winter and summer crops, respectively. Preservation of onions by irradiation on commercial scale revealed that treatment with 0.1 KGy irradiation dose and subsequent storage under the shade sinificantly reduced these losses. (A.B.).

45578 (INIS-mf–12687) **Radiation preservation of dry fruits on semi-commercial scale.** Wahid, M.; Sattar, A.; Jan, M.; Ahmad, A.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 11p. Order Number DE90636780. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The effect of irradiation (1.0 KGy) and packaging materials on insect infestation of dry fruits is discussed in this report. The results of ascorbic acid contents in relation to storage conditions and packaging materials are presented. It was observed that initialy there was no change in ascorbic acid in the fruit contents but with the passage of time there is significant loss of ascorbic acid. (A.B.).

45579 (INIS-mf–12688) **Radiation preservation of spices.** Badshah, A.; Tasnim, A.; Khan, M.; Sattar, A.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 3p. Order Number DE90636781. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The use of gamma irradiation for preservation of red hot pepper has been explained in report, as it can kill the harmful organisms without altering the organolpetic properties. The sample were dried and reduced to pass through 20 mesh. The samples were irradiated at different dose levels of 0, 2.5, 5.0, 7.5 and 10.0 KGy and results have been shown after different time intervals. Radiation and packaging treatments resulted normaly no effect on the color of dry fruits. (A.B).

45580 (INIS-mf–12689) **Radiation preservation of cooked foods.** Aurangzeb; Bibi, N.; Badshah, A.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jan 1989. 4p. Order Number DE90636782. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

NIFA annual report 1988-89.

The preservation of irradiated cooked food has been explained in this report under vacuum conditions. The samples were irradiated

at dose levels of 7.5 and 10.0 LGy. Measurement of fungal count was carried immediately after irradiation and after each 15 days of storage life upto 60 days of time interval. The samples were evaluated organolepticaly as well. It has been observed that no significance difference was observed among samples of irradiated and vacuum packed controls during storage for 45 days. (A.B.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 44009, 44027, 44359, 45319, 45467, 45532, 45533, 45534, 45535, 45631, 45632

45581 (AERE-R–13776) **Clusters of health effects associated with radiation around the world (excluding the UK).** Rose, K.S.B. UKAEA Harwell Lab. (UK). Environmental and Medical Science Div. Apr 1990. vp. Source: Available from H.M. Stationery Office, London, price Pound 94.00.

Several hundred investigations into health effects associated with various sources of radioactivity outside the UK are critically reviewed in 369 summaries in this compilation. Overall 109 statistically significant excesses or deficits (clusters) are identified, 84 positive and 25 negative. Fourteen of these clusters are associated with nuclear power stations. Only two clusters provide good evidence of a causal association, they are the thyroid abnormality and growth retardation clusters among children on Rongelap Island. A third cluster of childhood leukaemia in high fallout areas of southwest Utah may also be causal and a survey of similar high fallout areas in northern Utah seems merited. Most of the other 106 clusters come from surveys that have either severe limitations in their methodology or contain internal contradictory evidence. This comment applies particularly to all 14 clusters identified around nuclear power stations. The same conclusion is not necessarily true for a few of the clusters associated with relatively high levels of natural background radiation; although it is likely that these too are not caused by radiation, further study to confirm or deny this would be helpful. It is concluded that there is no reliable evidence from countries outside the UK of clusters being caused by nuclear power stations. This includes the area close to the only major nuclear fuel reprocessing plant outside Britain at Cap La Hague..

45582 (CEA-DPS–90-02/SEAPS) **Whole-body absorbed dose rate in a worker carrying a can with contaminated liquid on his back.** Le Grand, J.; Roux, Y. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire. 1990. 6p. (In French). Order Number DE90514708. Source: NTIS (US Sales Only), PC A02/MF A01.

The method used is briefly described: geometrical parametrization by a set of planes and photon transport simulation by Monte Carlo techniques. The whole-body absorbed dose rate and the maximum absorbed dose rate in the phantom representing the worker are calculated for five photon initial energies. In order to illustrate the dose variation in the phantom, the absorbed dose rates are also given at the head, at the breast and at the gonads.

45583 (CEPN–164) **Occupational radiation exposures at PWR type reactors: international comparison of some global indicators between 1975 and 1988.** Benedittini, M.; Tabare, M. Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France). Dec 1989. 49p. (In French). Contract EDF-SEPTEN/CEPN no NC 8194. Order Number DE90514714. Source: NTIS (US Sales Only), PC A03/MF A01.

This report presents occupational radiation exposures at PWRs for 1988 in eight countries, i.e. Belgium, Federal Republic of Germany, Finland, France, Japan, Sweden, Switzerland, United States. It updates the CEPN report no 145 which covered the 1975-1987 period. Only reactors in commercial operation since july 1974 are included in the analysis. As for the previous years, there is a general decrease of the mean annual collective dose per reactor: 2.42 man-Sv per reactor in 1988, while it was 2.56 man-Sv in 1987 and 2.83 man-Sv in 1986. The most important reduction concerns the US reactors (46% decrease since 1982) and those of the Federal Republic of Germany (49% decrease since 1981). This general trend is closely related to the dose reduction programs adopted in countries, combined with the positive impact of the past experience. However, despite this tendency, one may note a small increase of the collective occupational exposure for four out of the eight countries during the 1987-1988 period. The gap between lower and higher values is also continuously reducing: from respectively 0.67 man-Sv (Finland) and 3.66 man-Sv (US) in 1987 (factor of 5.5), to 0.88 man-Sv and 3.08 man-Sv in 1988 (factor of 3.5). Excluding Finland, the difference is reduced to a factor 2. These results show a clear tendency towards an uniformization of practices and operations. Annual collective dose results presented as a function of the number of operating years confirm previous results: for all units, a first period with a collective doses increase, followed by a relative stability or even a reduction, and then for some of them, a second increase. In 1988, the average annual collective dose per reactor for all PWRs is about 1.27 man-Sv after one operating year, 2.58 man-Sv after three years, and respectively 4.16, 3.86 and 3.96 man-Sv after seven, ten and fourteen years.

45584 (CONF-900144–) **Mutation induction in vivo and in vitro in human T-lymphocytes by ionizing radiation.** Albertini, R.J.; O'Neill, J.P.; Nicklas, J.A. Vermont Univ., Burlington, VT (USA). Genetics Lab. [1990]. 9p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract FG02-87ER60502. From Ionizing radiation damage to DNA: molecular aspects; Lake Tahoe, CA (USA); 16-21 Jan 1990. Order Number DE90014562. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are quantifying the induction of mutations in human T-lymphocytes following exposure to ionizing radiation. In vivo exposure effects were studied in blood samples from patients receiving radioimmunoglobulin therapy (RIT) with ^{131}I labeled anti-ferritin antibodies.In vitro exposure effects were studied in isolated T-lymphocytes (G_0 phase) exposed to gamma irradiation from a ^{137}Cs source. Both in vivo and in vitro exposures of human T-lymphocytes to ionizing radiations cause the induction of hprt mutations and an increase in the fraction of mutations resulting from gross structural alterations. Consistent with an estimate of 89–210 kb average deletion size is the observation that several hprt deletion mutations also show loss of linked anonymous DNA probes. 12 refs., 1 fig., 1 tab.

45585 (CONF-8910354–3) **Mechanisms of induction of specific chromosomal alterations.** Preston, R.J. Oak Ridge National Lab., TN (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From DNA damage and repair in human tissues conference; Upton, NY (USA); 1-4 Oct 1989. Order Number DE90015536. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There has been a great deal of discussion in the past few years on the mechanism of induction of chromosome aberrations by radiations and chemical agents, and also how similar alterations might arise "spontaneously." This is an important issue, and yet it is perhaps of greater significance to determine how specific aberrations might be induced, i.e., are they formed by the same mechanism as aberrations in general or are they produced by a different process. Another way of stating this is, are specific aberrations, such as those observed in individuals with birth defects or those present in many tumors, a subset of total aberrations that are observed because of a particular phenotype that they, in part, elicit. This paper will address these various possibilities in the form of the development of a hypothesis, rather than by a review of the published literature. 26 refs.

45586 (DOE/ER/60634–T3) **Theory of RBE: Seventh triennial report, January 1, 1987–December 31, 1990.** Katz, R. Nebraska Univ., Lincoln, NE (USA). Dept. of Physics. 15 Jul 1990. 40p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60634. Order Number DE90015380. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A central theme, that the probability of inactivation of the sensitive targets of a detector by gamma-rays as a function of dose can be mapped into the region surrounding the path of an energetic heavy ion, through the "local dose" deposited by its delta rays, has been the continuing basis of the present research. This yields a

detailed picture of the track of a single particle and a means of calculating the action cross-section, which lie at the base of the understanding of effects of energetic heavy ions.

45587 (DOE/ER/60654–3) **Determination of the cell and mucous distribution in the airways of the lung for modeling injury due to inhaled radon and radon daughters: Progress-performance report.** Mercer, R.R. Duke Univ., Durham, NC (USA). Dept. of Medicine. [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER60654. Order Number DE90016203. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The central objective of this research is to provide detailed data on airway structure necessary for estimation of the health risks associates with human exposures to randon and radon progeny. This is being done by morphometric and serial section analysis of the distribution of different cell types and mucous lining layer(s) in the lungs of rats and man from trachea to the terminal bronchiole. Obtaining the proposed data has required the development of new quantitative morphometric methods to determine relevant distributions of structural characteristics of cells and mucous lining layer(s) in the airways of the lungs. For instance, the nucleus is the most sensitive biologic target for radon exposures. In the proposed study the depth of the nucleus for each of the various cell types in large and small airways has been determined. 3 figs., 8 tabs.

45588 (EGG-BNCT–8777-Vol.4-No.4) **Power Burst Facility/ Boron Neutron Capture Therapy Program for Cancer Treatment: Volume 4, No. 4: Monthly bulletin.** Ackermann, A.L. (ed.); Dorn, R.V. III. EG and G Idaho, Inc., Idaho Falls, ID (USA). Apr 1990. 43p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015468. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Highlights of the Power Burst Facility Boron Neutron Capture Therapy (PBF/BNCT) Program during April 1990 include progress within the areas of: gross boron analysis in tissue, blood, and urine; analytical methodologies development for BSH (Borocaptate Sodium) purity determination; noninvasive boron quantitative determination; operator training was conducted and pharmacokinetic data obtained using a laboratory dog; dosimetry development continues on real-time neutron and gamma monitoring to provide treatment control capability; analytical radiation transport and interaction modeling for BNCT; large animal model studies; neutron source and facility preparation – PBF upgrades, required for environmental, safety, and OSHA compliance, continue; administration and common support; and PBF operations – training, safety, and preventive maintenance activities continue. 3 figs.

45589 (EGG-BNCT–8777-Vol.4-No.5) **Power Burst Facility/ Boron Neutron Capture Therapy Program for Cancer Treatment: Volume 4, No. 5: Monthly bulletin.** Ackermann, A.L. (ed.); Dorn, R.V. III. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1990. 29p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90015469. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Highlights of the Power Burst Facility Boron Neutron Capture Therapy (PBF/BNCT) Program during April 1990 include progress within areas of: gross boron analysis in tissue, blood, and urine; analytical methodologies development for BSH (Borocaptate Sodium) purity determination; noninvasive boron quantitative determination; analytical radiation transport and interaction modeling for BNCT; large animal model studies; neutron source and facility preparation; administration and common support; and PBF operations – routine operations continue. 6 figs., 1 tab.

45590 (ENEA-RT-SAG–89-05) **The determination of gross alpha activity in urine by microprecipitation with LaF3 and alpha spectrometry.** Jia, Guo Gang; Bazzarri, S.; Micci, F.; Testa, C. ENEA, Casaccia (Italy). Centro Ricerche Energia. Jan 1990. 17p. Order Number DE90514500. Source: NTIS (US Sales Only), PC A03/MF A01.

This paper describes a method for the determination of gross alpha activity (actinides) in urine. The method presents the advantage of being a relatively cheap, simple multipurpose analytical procedure. It consists of the coprecipitation of actinides as Fe/Ca phosphates and hydroxides, the purification as iron phosphate and the preparation of a LaF3 source; alpha spectrometry is then carried out without any electroplating procedure. In performance tests, the average recoveries of the method for actinides (except uranium) were about 83.8 plus/minus 8-1%. With a counting time of 1440 min and a counting efficiency of 38%, the detection limit resulted 0.25 mBq/l (6.8 fCi/l). The gross alpha activity in urine blanks ranged from 0.35 to 0.80 mBq/l (9.4 to 22 fCi/l).

45591 (LBL–27148-Rev.) **Indoor radon: Exploring policy options for controlling human exposures: Revision.** Nazaroff, W.W.; Teichman, K.Y. Lawrence Berkeley Lab., CA (USA). Mar 1990. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90014889. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Exposure to the radioactive decay products of radon is thought to be a leading cause of lung cancer, contributing to the incidence of thousands of cases annually in the United States. The average lifetime risk of lung cancer due to environmental radon exceeds 10^{-3} for individuals in the US population. This level of risk is much larger than those ordinarily considered sufficient to warrant intervention by government agencies to limit involuntary exposures to environmental contaminants. Furthermore, exposures vary over a wide range; indeed, many individuals receive exposures that are at least an order of magnitude larger than the average. Rapidly growing awareness of the indoor radon problem in North America and Europe has generated pressure for governments to take action. In the United States, elements of a national policy have been put forth, such as the recommendations to citizens by the Environmental Protection Agency (EPA) and the Centers for Disease (CDC), and the recent adoption of an amendment to the Toxic Substances Control Act (TSCA). The purpose of this article to explore federal policy options for controlling indoor radon. We focus on current EPA/CDC policy and on the TSCA amendment, emphasizing the numbers of lung cancers that may be avoided, the costs of implementing control measures, and the prospects for attaining the policy goals. Potential problems in identifying and mitigating high indoor concentrations are considered. Some characteristics that might be expected in a comprehensive policy are presented. First, an overview of the problem is provided as a foundation for subsequent discussion. 49 refs., 2 tabs.

45592 (PB–90-232208/XAB) **Assigned shares in compensation for radiation-related cancers.** Lagakos, S.W.; Mosteller, F. Harvard Univ., Boston, MA (USA). School of Public Health. ©1986. 34p. Source: NTIS, PC A03/MF A01.

Pub. in Risk Analysis, Vol. 6, No. 3, 345-357(Sep 1986).

The preparation of radioepidemiologic tables requires extensive mathematical modeling because matters such as sex, size of dose, age at exposure, type of cancer, and age at diagnosis must be taken into account. The limited data require many assumptions about the quantitative relationship between radiation dose and the age-specific incidence rate of cancer. After partitioning a population into reference sets based on age at exposure, size of dose, type of cancer, etc., an assigned share is computed for each reference set and then assigned to all of its members. The assigned share represents the fraction of the cancer cases in the reference set that are attributed to the radiation dose. Because the population can be partitioned in many ways, each individual's assigned share depends on the partition used and will change with different partitions. Options for modeling and limitations in epidemiologic data lead to considerable uncertainties in estimates of assigned charges that have been scientifically evaluated. In contrast, the uncertainties associated with the current approach for determining the likelihood a cancer was caused by radiation have not been appraised but are likely to be even greater than those associated with the tables.

45593 (PB–90-232257/XAB) **Bronchial deposition of inhaled particles: Dosimetry implications for radon progeny.** Hofmann, W.; Martonen, T.B. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. ©1988. 8p. (EPA–600/J-88/521). Source: NTIS, PC A02/MF A01.

Pub. in Radiation Protection Dosimetry, Vol. 16, 261-265(Dec 1988).

Radon progeny attached to environmental aerosols have characteristic activity median diameters between 0.1 and 0.3 micrometer. A comparison of experimental and theoretical particle deposition

patterns in human lungs has revealed certain systematic inconsistencies among measured and predicted distributions within this range of particle sizes. It is the objective of the focused note to address the potential significance of the apparent discrepancies and comment how current lung dosimetry and risk estimates for inhaled radon progeny would be affected.

45594 (PB–90-232349/XAB) **Methods for analyzing occupational cohort data with application to lung cancer in US uranium miners: Techniques for fitting and checking exposure-time-response models.** Halpern, J.; Whittemore, A.S. Stanford Univ., CA (USA). School of Medicine. ©1987. 12p. Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Chronic Diseases, Vol. 40, Suppl. 2, 79S-88S(Mar 1987).

Two methods were used to examine how lung cancer death rates vary with cumulative exposures to radiation and tobacco among uranium miners. The two methods produced similar results when death rate ratios were taken to be the product of radiation and tobacco effects. The estimates were discrepant when death rate ratios were taken to be the sum of radiation and tobacco effects. Both methods indicated better fit for the multiplicative model. It may be that cumulative exposures are inappropriate measures of the effects of radiation and tobacco on lung cancer death rates, as well as for other pollutants where the assumption of cumulative dose is the basis for risk assessments.

45595 (PB–90-242298/XAB) **NVLAP Program handbook: Personnel radiation dosimetry. Requirements for accreditation.** Gladhill, R.L. National Voluntary Lab. Accrediation Program, Gaithersburg, MD (USA). Jul 1989. 71p. (NISTIR–89/4125). Source: NTIS, PC A04/MF A01.

The document explains the operation and technical requirements of the Laboratory Accreditation Program for Personnel Radiation Dosimetry. All of the steps leading to accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied. It is intended for use by staff of accredited laboratories, those seeking accreditation, other laboratory accreditation systems, and others needing information on the requirements for NVLAP accreditation.

45596 (PNL-SA–16120) **Modeling the dynamics of long-term cycling and storage of ^{137}Cs in forested ecosystems: Chernobyl case study.** Van Voris, P. (Pacific Northwest Lab., Richland, WA (USA)); Cowan, C.E.; Cataldo, D.A.; Wildung, R.E.; Shugart, H.H. Pacific Northwest Lab., Richland, WA (USA). Jul 1988. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE90016286. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A microcomputer digital simulation model (RADFORET) was developed to predict the long-term cycling of radiocesium (^{137}Cs) in forested ecosystems using detailed ^{137}Cs distribution data from two ecosystems. The primary forcing functions for the model were the concentration of ^{137}Cs in the soil compartment and the rate of forest growth. Parameters were set for controlling the movement of ^{137}Cs from soil into, and subsequent cycling within, the biotic compartments of the model for each ecosystem. The amount of the ^{137}Cs available for uptake from the soil was inversely correlated with the clay content in the soil from each site and was positively correlated with cation exchange capacity (CEC) and soil organic matter. The effect of forest growth as a forcing function the ^{137}Cs cycling model was simulated by coupling the output of a microcomputer digital simulation forest growth succession model (FORET) to the RADFORET cycling model. Thus, the ^{137}Cs concentration in each of the seven compartment of the model resulted from both the donor-controlled linear differential equation model of ^{137}Cs concentration in the soil and the dynamics of forest biomass over time. Forecasts of ^{137}Cs distribution in the donor-controlled model favorably compared with actual ^{137}Cs distributions in forest at Oak Ridge, Tennessee, and Savannah River, Georgia. This comparison provided a measure of model validity for additional simulations of projected ^{137}Cs cycling in the forests around the Chernobyl nuclear reactor accident site in the USSR. 58 refs., 8 figs., 3 tabs.

45597 (PNL-SA–17906) **Microdosimetric measurements of heavy ion tracks.** Braby, L.A.; Toburen, L.H.; Wilson, W.E.; Metting, N.F. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9006220–3: 28. COSPAR plenary conference, The Hague (Netherlands), 25 Jun - 6 jul 1990). Order Number DE90015551. Source: NTIS, PC A; GPO Dep.

The biological effectiveness of radiations depends on the spatial pattern of ionizations and excitations produced by the charged particle tracks involved. Ionizations produced by both the primary ion and by energetic delta rays may contribute to the production of biologically relevant damage and to the concentration of damage which may effect the probability of repair. Although average energy concentration (dose) can be calculated using homogenous track models, the energy is actually concentrated in small volumes containing segments of the ion and delta ray tracks. These local concentrations are studied experimentally using low pressure proportional counters, and theoretically, using Monte Carlo methods. 22 refs., 11 figs.

45598 (PNL-SA–18193) **Biological effects of inner-shell ionization.** Toburen, L.H.; Wilson, W.E. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900757–4: 15. international conference on x-ray and inner-shell processes, Knoxville, TN (USA), 9-13 Jul 1990). Order Number DE90016295. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Inner-shell ionization and the subsequent x-ray and Auger-electron cascades resulting from the filling of inner-shell vacancies play important roles in radiation biology. Radioisotopes, such as ^{125}I, that form inner-shell vacancies by electron capture and internal conversion processes, are found to be particularly effective in producing biological damage. Because of the short range of Auger electrons emitted in the filling of inner-shell vacancies the degree of biological response is strongly dependent of the position of the radionuclide relative to the sensitive elements of the cell. The actual type and amount of damage produced by the filling of an inner-shell vacancy depends on the position of the excited atom in the cell, the energy and number of Auger electrons emitted following inner-shell ionization, and the chemical environment surrounding the Auger emitter. Examples of the effects of variations in these parameters on the subsequent chemical and biological response are discussed in this report with emphasis on studies of the incorporation of ^{125}I in mammalian cell systems. 16 refs., 6 figs.

45599 (RERF-TR–4-88) **Risk of cancer among in utero children exposed to A-bomb radiation, 1950-84.** Yoshimoto, Yasuhiko; Kato, Hiroo; Schull, W.J. Radiation Effects Research Foundation, Hiroshima (Japan). Jan 1990. 27p. (In Japanese, English). Order Number DE90513645. Source: NTIS (US Sales Only), PC A03/MF A01.

This study examines the risk of cancer (incidence) over a period of 40 years among the inutero exposed survivors of the atomic bombing of Hiroshima and Nagasaki, and adds eight years of follow-up to a previous report which was confined to mortality. Only two cases of childhood cancer were observed among these survivors in the first 14 years of life; both had been heavily exposed. Subsequent cancers have all been of the adult type. Not only did the observed cancers occur earlier in the $\geq$ 0.30 Gy dose group than in the 0 Gy dose group but the incidence continues to increase and the crude cumulative incidence rate, 40 years after the A-bombing, is 3.9-fold greater in the $\geq$ 0.30 Gy group. In the observation period 1950-84, based on the absorbed dose to the mother's uterus, as estimated by the Dosimetry System 1986 (DS86), the relative risk of cancer at 1 Gy is 3.77 with a 95% confidence interval of 1.14-13.48. For the entire $\geq$ 0.01 Gy dose group the average excess risk per 10^4 person-year-gray is 6.57 (0.07-14.49) and the estimated attributable risk is 40.9% (2.9%-90.2%). These results, when viewed in the perspective of fetus doses, suggest that susceptibility to radiation-induced cancers is higher in prethan in postnatally exposed survivors (at least those exposed as adults). However, definitive conclusions must await further follow-up studies. (author).

45600 (RERF-TR-12-89) **Incidence of thoracic vertebral fractures among adult health study participants, Hiroshima and Nagasaki, 1958-86.** Fujiwara, Saeko; Mizuno, Shoichi; Ochi, Yoshimichi; Sasaki, Hideo; Kodama, Kazunori; Russell, W.J.; Hosoda, Yutaka. Radiation Effects Research Foundation, Hiroshima (Japan). Jan 1990. 17p. Order Number DE90513644. Source: NTIS (US Sales Only), PC A03/MF A01.

The incidence of thoracic vertebral fractures (TVF) in a fixed Hiroshima and Nagasaki population of 16,027 was determined by sex, age, and atomic bomb ionizing radiation exposure. Diagnosis was based on lateral chest radiographs made from 1 July 1958 to 28 February 1986. Born between 1880 and 1940, the subjects were categorized by sex into 10-year birth cohorts. When examined by birth cohort and age at onset, the age dependency of TVF incidence showed a good fit to a log-linear regression model. In females, TVF incidence tended to be lower in the younger birth cohorts and tended to increase with age in all birth cohorts. With each 10-year increase in age, the incidence among females increased by a factor of 1.7. In males, the incidence was significantly lower in the younger birth cohorts, but did not increase with age. The incidence decreased by a factor of 0.5 in males and 0.6 in females as the birth cohort age became younger. TVF incidence was greater in males until the age of 50, was equal by sex in the sixth decade, and was greater among females, who were 60 years of age or older. TVF incidence did not differ by city, and no correlation with A-bomb radiation exposure was demonstrated. (author).

45601 (RERF-TR-14-89) **Serum ferritin and stomach cancer risk among A-bomb survivors.** Akiba, Suminori; Neriishi, Kazuo; Blot, W.J.; Kabuto, Michinori; Stevens, R.G.; Kato, Hiroo; Land, C.E. Radiation Effects Research Foundation, Hiroshima (Japan). Feb 1990. 13p. Order Number DE90513646. Source: NTIS (US Sales Only), PC A03/MF A01.

Using stored serum samples collected from 1970-72 and/or from 1977-79, serum ferritin, transferrin, and ceruloplasmin levels were immunologically determined for 233 stomach cancer and 84 lung cancer cases diagnosed from 1973-83 and for 385 matched controls from a fixed population of Hiroshima and Nagasaki atomic bomb survivors. Elevated stomach cancer risk was associated with low serum ferritin levels, with more than a threefold excess among those in the lowest quintile as compared to the highest ferritin quintile. The average serum ferritin concentration was 8% lower in the stomach cancer cases than in the controls. Risk did not vary with the time between blood collection and stomach cancer onset, remaining high among those with low ferritin levels five or more years before cancer diagnosis. Low ferritin combined with achlorhydria, diagnosed about 10 years before the blood collection and up to 25 years before cancer diagnosis, was an exceptionally strong marker of increased stomach cancer risk. No effect of transferrin or ceruloplasmin independent of ferritin was observed on gastric cancer risk. Lung cancer risk was not related to these three serum proteins. (author).

45602 (RERF-TR-17-89) **Absence of correlations between the radiosensitivity of human T-lymphocytes at G_0 and skin fibroblasts at log phase from the same individuals.** Kushiro, Jun-ichi; Nakamura, Nori; Kyoizumi, Seishi; Nishiki, Masayuki; Dohi, Kiyohiko; Akiyama, Mitoshi. Radiation Effects Research Foundation, Hiroshima (Japan). Jan 1990. 18p. Order Number DE90513647. Source: NTIS (US Sales Only), PC A03/MF A01.

Matched samples of peripheral T-lymphocytes and skin fibroblasts from a total of 22 patients who underwent various surgical procedures were tested for a dose-survival study using loss of colony-forming ability as the end point. The results showed that the mean D_{10} (the dose required to kill 90 % of the cells) $\pm$SD was 3.58 $\pm$ 0.21 Gy for T-lymphocytes irradiated at G_0 and 3.19 $\pm$ 0.37 Gy for skin fibroblasts irradiated at log phase. The coefficient of variation was found to be 6 % and 11 %, respectively. Contrary to expectation, regression analysis of the D_{10} values for the two cell types revealed no significant correlations. The absence of correlation is most probably derived from the fact that the apparent interindividual variability of dose-survival curves is largely caused by random experimental fluctuations, at least for lymphocytes. Possible reasons for the greater variability observed in the fibroblast assay are discussed. (author).

45603 (UCD-472-135) **Laboratory for Energy-Related Health Research final annual report, fiscal year 1989.** Abell, D.L. (ed.). California Univ., Davis, CA (USA). School of Veterinary Medicine. Mar 1990. 196p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00472. Order Number DE90014822. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This Final Annual Report to the US Department of Energy summarizes research activities for the period from 1 October 1988 to 30 September 1989 at the Laboratory for Energy-related Health Research (LEHR). This is the twenty-fourth annual report of the Laboratory for Energy-related Health Research, and the last of the series. The laboratory's overall research objective has been to provide new knowledge for an improved understanding of the potential bioenvironmental and occupational health problems associated with energy utilization. Our purpose is to contribute to the safe and healthful development of energy resources for the benefit of mankind. This research encompasses several areas of basic investigation that relate to toxicological and biomedical problems associated with potentially toxic chemical and radioactive substances and ionizing radiation with particular emphasis on carcinogenicity. Studies of systemic injury and nuclear-medical diagnostic and therapeutic methods are also involved. The principal themes of the different types of research at LEHR have centered around the biology, radiobiology, and health status of the skeleton and its blood-forming constituents; the behavior of bone-seeking radionuclides; the beagle as an experimental animal model; radiation carcinogenesis; and the scaling of the results from laboratory animal studies to man for appropriate assessment of risk. This report summarizes key aspects of recent research, describes the status of the lifetime study of Sr-90 and Ra-226 in beagles in the first section, and provides historical information about the work performed during the period from 1955 to 1989 including a listing of the open literature publications.

45604 Use of a ring chromosome and pulsed-field gels to study interhomolog recombination, double-strand DNA breaks and sister-chromatid exchange in yeast. Game, J.C. (Lawrence Berkeley Lab., CA (USA)); Sitney, K.C.; Cook, V.E.; Mortimer, R.K. *Genetics (USA)*, 123(4): 695-713 (Dec 1989).

The authors describe a system that uses pulsed-field gels for the physical detection of recombinant DNA molecules, double-strand DNA breaks (DSB) and sister-chromatid exchange in the yeast Saccharomyces cerevisiae. The system makes use of a circular variant of chromosome II (Chr. III). Meiotic recombination between this ring chromosome and a linear homolog produces new molecules of sizes distinguishable on gels from either parental molecule. They demonstrate that these recombinant molecules are not present either in strains with two linear Chr. III molecules or in rad50 mutants, which are defective in meiotic recombination. In conjunction with the molecular endpoints. They present data on the timing of commitment to meiotic recombination scored genetically. They have used x-rays to linearize circular Chr. III, both to develop a sensitive method for measuring frequency of DSB and as a means of detecting double-size circles originating in part from sister-chromatid exchange, which they find to be frequent during meiosis.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 43843, 44975, 45291, 45295, 45300, 45301, 45329, 45333, 45461, 45475, 45476, 45477, 45479, 45482, 45483, 45484, 45487, 45488, 45489, 45495, 45504, 45505, 45506, 45510, 45535, 45553, 45585

45605 (AD-A-221131/6/XAB) **Biological model of the effects of toxic substances. Final report, 1 July 1989-1 January 1990.** Tuckett, R.P. Topical Testing, Inc., Salt Lake City, UT (USA). 28 Feb 1990. 43p. Source: NTIS, PC A03/MF A01.

Due to the basic nature of military operations, it is sometimes necessary for Air Force personnel to be exposed to toxic chemicals in their work environment either as a protracted low-level exposure or as a high-level, acute exposure. The application herein proposes to use the anterior eye (cornea and conjunctiva) and its sensory innervation as an assay of toxic effects. The anterior eye

has unique characteristics: its extensive use in toxicology, permeability, the relative ease of observation, and importance to the input of visual information. In addition, the eye is unique in that receptors innervating the cornea differ from those innervating conjunctiva and hence comparisons of these populations will likely be useful to assay for deficits in performance of different types of sensory neurons. The personnel of Topical Testing have expertise in growing (and recording from) neural tissue in culture, as well as the design and fabrication of specialized equipment used in such studies. This phase I feasibility study will investigate the use of an ocular-neuronal model as an indicator of toxic insult. Phase II development will establish a model tissue culture system with an eventual goal of investigating mechanisms to enhance natural detoxification.

45606 (CONF-881185–2) **Electron attachment and ion mobility in hydrocarbons and related systems.** Bakale, G. Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology. [1988]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60617. From International workshop on liquid state electronics; Berlin (Germany, F.R.); 7-10 Nov 1988. Order Number DE90016016. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During the last two decades, a firm base for the emerging field of liquid state electronics (LSE) has developed through studies of the transport and reaction properties of excess electrons in a variety of liquid-phase systems. Pulse-conductivity techniques were used in many of these studies to measure the mobilities of electrons and ions in pure liquids as well as the rate constants of electron attachment to a wide variety of electron-accepting solutes. Results obtained through such studies have interdisciplinary implications that are described in the discussion that follows which includes examples of the contributions of LSE to physics, chemistry and biology. 42 refs.

45607 (CONF-8907113–14) **Results of screening NCI/NTP nongenotoxic carcinogens and genotoxic noncarcinogens with the k_e test.** Mendelsohn, M.L. (ed.); Bakale, G.; McCreary, R.D. Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology. [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60617. From 5. international conference on environmental mutagens; Cleveland, OH (USA); 10-15 Jul 1989. Order Number DE90016015. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The interdependence of the electrophilic and carcinogenic properties of chemicals that was demonstrated two decades ago rekindled interest in the somatic mutation theory of carcinogenesis. Interest in this theory grew with the development of a reverse-mutation bacterial assay in the laboratory of B.N. Ames that permitted the mutagenic properties of the chemicals to be determined quickly and yielded results which indicated that "carcinogens are mutagens." Subsequent validation studies of this bioassay, the Salmonella typhimurium/microsome or "Ames test," by Ames' group and others provided additional support for the correlation between mutagenicity and carcinogenicity which led to the worldwide deployment of the Ames test in thousands of laboratories and to the development of more than 100 other short-term tests that continue to be used to identify potential carcinogens via various end-points of genotoxicity. This document discusses electrophilicity, mutagenicity, and carcinogenicity relationships as well as carcinogen-screening of chemicals. 28 refs., 4 tabs.

45608 (CONF-9009221–2) **Disulfur decafluoride (S_2F_{10}): A review of the biological properties and our experimental studies of this breakdown product of SF_6.** Griffin, G.D.; Ryan, M.S.; Kurka, K.; Nolan, M.G.; Sauers, I.; James, D.R. Oak Ridge National Lab., TN (USA). [1990]. 12p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 6. international symposium on gaseous dielectrics; Knoxville, TN (USA); 23-27 Sep 1990. Order Number DE90016029. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The toxicity of S_2F_{10} (disulfur decafluoride) to whole animals and to cells is discussed. The strong toxicity of S_2F_{10}, comparable to the toxicity of phosgene in some species, suggested the possible use of S_2F_{10} as a warfare agent. Exposures to as little as 0.1 ppm for 18 h have produced lung irritation in rats. Cell culture studies in our laboratory have shown S_2F_{10} to be by far the most toxic product we have so far identified in laboratory samples of electrically-decomposed SF_6. The significance of these toxicological studies for electrical utility personnel depends on the presence and amount of S_2F_{10} found in actual applications and the effectiveness of clean-up methods applied to faulted gas equipment.

45609 (DOE/ER/60617–4) **Ionization in liquids: Progress report, November 1, 1987–October 31, 1990.** Bakale, G. Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology. 30 Apr 1990. 45p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60617. Order Number DE90015861. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

During the 1987–1990 reporting period, studies were conducted that entailed the direct measurement of the transport and reaction properties of excess electrons in nonpolar liquids through the use of pulse-conductivity techniques. The results obtained from these studies should be applicable toward the development of a better understanding of the primary ionizing event in liquids as well as to providing physico-chemical information that is pertinent to electron-transfer processes that are ubiquitous in biological systems. Progress was also made in developing a better understanding of electron attachment reactions in liquids through measurements of the electron attachment rate constants, k_es, of a variety of electron-attaching solutes. The effects of several functional groups substituted at different positions on benzene were studied in liquid cyclohexane and isooctane. The electron-attaching properties of chemicals having well characterized carcinogenic properties were studied in cyclohexane to determine if the measure of electron-accepting potential that k_e provides can elucidate the role that electrons play in the initiation step of carcinogenesis. The k_es that were measured indicate that the k_e-carcinogenicity correlation that was observed can be used to complement short-term carcinogen-screening bioassays to identify potential carcinogens. 115 refs., 6 tabs.

45610 (DOE/ER/60657–3) **Initiation, promotion, initiation experiments with radon and cigarette smoke: Lung tumors in rats: Progress report.** Moolgavkar, S.H. Fred Hutchinson Cancer Research Center, Seattle, WA (USA). Feb 1990. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER60657. Order Number DE90016124. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Much recent attention has focused on the recessive oncogenesis model according to which inactivation of both alleles of a tumor suppressor gene (anti-oncogene) leads to cancer. Over the past decade Dr. Moolgavkar has been involved in the development and testing of a two-mutation model for carcinogenesis, which may be viewed as a mathematical generalization of the recessive oncogenesis model. In a series of papers this model has been shown to be consistent with a large body of epidemiologic and experimental data. Thus, the current project funded under the auspices of DOE, is part of a much larger program. The goals of this larger program are: the mathematical development of the two-mutation model for application to various epidemiologic and experimental data sets; investigation of the statistical properties of the model and development of software for fitting the model to various data sets, including cohort and case-control data in epidemiology. Directly relevant to the radon program, we have completed an analysis of radon-induced lung tumors in rats within the context of the two-mutation model. We found that the model described the data well. The results indicate that fractionation of exposure increased the lifetime probability of tumor. Examination of the parameters of the model suggests that the effect of fractionation can be explained by the relative effects of radon daughters on the mutation rates and on the kinetics of growth of initiated cells. The first mutation rate is very strongly dependent upon the rate of exposure to radon daughters, the second mutation rate much less so, suggesting that the nature of the two mutational events is different.

45611 (ETDE-IT–90-33) **SEM analysis of injures induced in the trachea of rat by inhalation of sodium combustion products.** Pagano, P.; Calamosca, M.; Forner, G.; Fagarazzi, G.; Bruni, S. ENEA, Bologna (Italy). Feb 1989. 3p. (CONF-8902181–1: International symposium on inhalation toxicology, Hannover (Germany,

F.R.), 19-24 Feb 1989). Order Number DE90514509. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the congress on assessment of inhalation hazards: Integration and extrapolation using diverse data (Hannover, 19-24 Feb 1989).

The ENEA (Italian Commission for Alternative Energy Sources) Laboratory in Bologna is interested in the inhalation toxicology of airborne particles. At the Lab, the injuries produced by these substances in the respiratory tract of rats are analyzed by scanning electron microscopy (SEM) and the damage to the mechanical systems of defence of the respiratory system is estimated by radiometric techniques. This paper reports on five inhalation experiments (exposure time 30 min each) with different concentrations of sodium combustion products (almost 100% carbonate). Sprague-Dawley rats were put into special tubes and connected to the inhalation chamber. The test results showed that the tracheal injury entity directly depends on the concentration and that by reducing the concentration, the extension and severity of the injuries gradually decrease without threshold effect.

45612 (IAEA-TECDOC–554) **Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989.** Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Apr 1990. 142p. (CONF-8903231–: Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants, Ankara (Turkey), 13 Mar 1989). Order Number DE90636758. Source: NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS.

Agricultural fungicides are chemicals used on seeds, crops and in soils throughout the growing season. Fungicide treatments may lead to various levels of chemical residues in food commodities. Primary emphasis has been placed on ethylenebisdithiocarbamates (EBDCs), an important group of agrofungicides used in preparations for spraying or dusting major crops such as apples, pears, broccoli, cabbages, egg plants, cauliflower, grapes, lettuce, peppers, celery, cucumbers and tomatoes. Treatments with EBDCs result in terminal residues containing ethylenthiourea (ETU). This is a toxicologically significant decomposition product which has attracted considerable attention in recent years due to indications of its potential goitrogenic and carcinogenic properties. In recognition of the need for a coordinated examination of ETU levels in food, particularly under tropical conditions, the program of radiotracer techniques as a tool for studying fungicide residue problems on food was initiated in 1984. In current studies, three EBDCs, maneb, zineb and mancozeb from different manufacturers in different countries were analysed. This report describes the model protocols (Annexes I, II and III) as they were set up for determination of residues in commodities and soil, using radiotracer and conventional chromatographic techniques . In the 16 papers presented in this report C^{14}-labelled EBDCs are determined in plants, vegetables, and soils, before and after cooking, as a function of time and of other agricultural parameters. Refs, figs and tabs.

45613 (PB–90-215054/XAB) **Drinking-water quantification of toxicologic effects for nickel. Draft report.** Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. Feb 1990. 79p. (ECAO-CIN–443). Source: NTIS, PC A05/MF A01.

The document provides the health effects basis to be considered in establishing the MCLG. To achieve this objective, data on toxicokinetics, and acute, subchronic and chronic toxicity to animals and humans are evaluated. Specific emphasis is placed on data published in peer-reviewed literature providing dose-response information. Thus, while the literature search and evaluation performed in the development of the document have been comprehensive, only the reports considered most pertinent in the derivation of the MCLG are cited in the document. The comprehensive literature data base in support of the document includes information published up to 1989; however, more recent data may have been added during the review process.

45614 (PB–90-215989/XAB) **Ultramicro forward-mutation assay and it's application to the survey of indoor air pollution.** Takagi, Y.; Goto, S.; Kuo, C.T.; Sugita, S.; Murata, M. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. ©1988. 11p. (EPA–600/J-89/361). Source: NTIS, PC A03/MF A01.

Text in Japanese; summary in English. Pub. in Jnl. Japan Soc. Air Poliut., Vol. 23, No. 3, 244-251(1988).

A highly sensitive ultramicro forward-mutation assay using Salmonella typhimurium TM677 was achieved by the introduction of a micro-vessel in the preincubation. The assay was about 10 times higher in sensitivity than the micro forward-mutation assay and was able to measure mutagenicity of extracts from airborne particulates obtained by only 3 cu m air sampling. Repeatability of the assay was nearly same as that of the micro forward-mutation assay, that is, the coefficient of variation of the mutation frequency for airborne particular extracts was 12.3% in the test condition without S9 mix and 13.7% with S9 mix. The assay was applied to the measurement of hourly variation mutagenic activity of airborne particulates indoors and outdoors, and revealed the mutagenic activity of indoor air was generally higher than that of outdoor air and that the mutagenic activity indoors in the absence of S9 mix was well correlated with human activity. It was also found by the assay and PAH analysis that indoor pollution by carcinogens and mutagens was largely affected by cigarette smoking and an air cleaner was useful for reduction of indoor pollution by mutagens and PAHs.

45615 (PB–90-221722/XAB) **Epidemiological evidence for aggravation and promotion of COPD by acid air pollution.** Dockery, D.W.; Speizer, F.E. Harvard Univ., Boston, MA (USA). School of Public Health. ©1989. 29p. Source: NTIS, PC A03/MF A01.

Pub. in Clinical Epidemiology of Chronic Obstructive Pulmonary Disease, Chapter 10, 201-225(Sep 1989).

The chapter discusses epidemiologic evidence for the role of acidic aerosols in the development and exacerbation of chronic obstructive pulmonary disease. The hypothesis that sulfuric acid was the most important component of the mix of pollutants responsible for classic air pollution episodes was first proposed more than 50 years ago. However, analyses of these episodes and more recent epidemiologic studies of lower level exposures are suggestive but not conclusive, primarily because of the limitations in technology available for measuring exposure.

45616 (PB–90-221748/XAB) **Analysis of the mechanism of methyl mercury cytotoxicity.** Massaro, E.J.; Elstein, K.H.; Zucker, R.M. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. ©1990. 10p. (EPA–600/D-90/042). Source: NTIS, PC A02/MF A01.

MeHg-induced perturbation of the cell cycle kinetics of the murine erythroleukemic cell (MELC) has been investigated by flow cytometry (FCM). It was observed that, at relatively low levels (2.5 - 7.5 microM), MeHg predominately inhibits progression through the S phase of the cell cycle (in a dose-dependent manner). Accumulation of cells in the G2/M phase of the cycle also occurs, but to a considerably lesser extent. Light microscopy reveals a dose-dependent increase in incidence of chromosomal aberrations (condensation, pulverization). Higher dose levels (10 - 50 microM), induce chromosomal ring formation and progressive perturbation of the cell membrane/cytoplasm complex. The latter is manifested as increased 90 deg light scatter (refractive index), decreased axial light loss (cell size), simultaneous propidium iodide and carboxyfluorescein fluorescence, and resistance to detergent (NP-40)-mediated cytolysis. Observations indicate that DNA synthesis is the primary target of MeHg cytotoxicity and that apparent targets and degree of cytotoxicity are a complex function of dose.

45617 (PB–90-225590/XAB) **Health assessment for Ambler Asbestos Piles, Ambler, Pennsylvania, Region 3 (addendum to). CERCLIS No. OAD000436436. Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). 13 Sep 1989. 5p. Source: NTIS, PC A01/MF A01.

See also PB–90-144205.

In compliance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act, as amended, the Agency for Toxic Substances and Disease Registry (ATSDR) has prepared Health Assessment reports for sites currently on, or proposed for, the National Priorities List (NPL). Health Assessments are also prepared for non-NPL

sites in response to requests from States and individuals. In the report, the presence and nature of health hazards at the site are assessed, and the public health implications specific to the site are evaluated. The Health Assessment is based on such factors as the nature, concentration, toxicity, and extent of contamination at the site; the existence of potential pathways for the human exposure; the size and nature of the community likely to be exposed; and any other information available to ATSDR that is relevant to a determination of potential risks to public health.

45618 (PB–90-225624/XAB) **Crystal Chemical Company, arsenic exposure study, Houston, Texas, Region 6. Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). Jul 1989. 58p. (ATSDR/HS–90/09). Source: NTIS, PC A04/MF A01.

See also PB–90-111493.

A human exposure study was conducted to determine if adults or children living near an abandoned arsenic production site frequented the on-site or off-site contaminated areas, to measure recent exposure to arsenic through analysis of urine samples, and to determine if activity or time spent at the contaminated site was correlated with arsenic levels in urine. In the study the difference in urine arsenic levels by areas that residents frequented was not statistically significant; all group means by area frequented were less than 50 microg/g creatinine. Although the Crystal Chemical Company Superfund site is a potential health hazard to anyone going on-site or playing in the dirt or runoff adjacent to the site, results of the study did not indicate unusual exposure among residents in the nearest apartment complex, with the exception of three children. The survey also served as a means of alerting the residents to stay away from the contaminated and potentially contaminated areas.

45619 (PB–90-225640/XAB) **Study of disease and symptom prevalence, Newsom Brothers National Priorities List Site, Columbia, Mississippi, Region 4. Final report.** Agency for Toxic Substances and Disease Registry, Atlanta, GA (USA). Oct 1989. 50p. (ATSDR/HS–90/04). Source: NTIS, PC A03/MF A01.

Columbia, Mississippi is the site of an abandoned chemical manufacturing plant that was contaminated with several VOCs and was included in the EPA's National Priorities List in 1986. The Agency for Toxic Substances and Disease Registry (ATSDR), in cooperation with the Mississippi State Department of Health, conducted a survey of disease and symptom prevalence. The objective of the survey was to determine whether the community living near the site (within a 1/4 mile radius of two on-site ponds) had an excess prevalence of specific self-reported diseases or symptoms, compared with an appropriate community not situated near the site. The results of the study show that residents ages 12 years and older living near the site reported more constitutional complaints (numbness, tingling or prickling, rash, watery or burning eyes, wheezing chest pain, dizziness) and memory loss than did the comparison community. No significant differences were found in self-reported symptoms or diseases among children in the two areas. No environmental exposure pathways or their resulting toxicological processes are known to explain the uniform increase in symptoms seen in the study. The apparent elevation in reported symptoms may reflect increased perception or recall of conditions by the respondents living near the site.

45620 (PB–90-231127/XAB) **Toxicology and carcinogenesis studies of benzofuran (CAS No. 271-89-6) in F344/N rats and B6C3f1 mice (gavage studies). Technical report series.** Irwin, R. National Toxicology Program, Research Triangle Park, NC (USA). Oct 1989. 186p. (NTP-TR–370). Source: NTIS, PC A09/MF A01.

Benzofuran is used as an intermediate in the polymerization of coumarone-indene resins found in various corrosion-resistant coatings such as paints and varnishes, in water-resistant coatings for paper products and fabrics, and in adhesives approved for use in food containers. Toxicology and carcinogenesis studies were conducted by administering benzofuran (approximately 99% pure) in corn oil by gavage to groups of F344/N rats and B6C3F1 mice of each sex for 14 days, 13 weeks, or 2 years. Genetic toxicology tests were conducted in Salmonella typhimurium, mouse lymphoma cells, and Chinese hamster ovary (CHO) cells.

45621 (PB–90-231200/XAB) **Processing hazardous materials: Risk information at the local level. Final report on Phase 1.** Conn, W.D.; Owens, W.L.; Rich, R.C.; Manheim, J.B. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Center for Environmental and Hazardous Material Studies. Dec 1988. 61p. Source: NTIS, PC A04/MF A01.

See also PB–90-235938.

The pilot study examines the role of Local Emergency Planning Committees (LEPCs, set up under Title III of the Superfund Amendments and Reauthorization Act) in communicating about the risks from hazardous wastes in Superfund or RCRA sites as well as the risks from hazardous substances covered under the Community Right-to-know Law. This phase evaluated the usefulness of certain hazard analysis materials to the LEPCs. Eighty LEPCs in Virginia were surveyed about their activities and their perceptions of their responsibilities for communicating to their communities about Title III risks. The major conclusion for Phase I is that LEPCs were emphasizing the development of their local emergency plans. Communicating with the local citizenry was a secondary concern at that time. Phase II is examining how things have changed across 10 states.

45622 (PB–90-232133/XAB) **Rationale for assessment of risk from exposure to 2,3,7,8-TCDD.** Mukerjee, D.; Stara, J.F.; Schaum, J.L. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. ©1986. 10p. (EPA–600/J-86/524). Source: NTIS, PC A02/MF A01.

Pub. in Chemosphere, Vol. 15, No. 9-12, 1805-1813(1986).

The human health risk assessment is supported by methodology for utilizing toxic effects in animals consisting of carcinogenic and noncarcinogenic responses as a result of chronic, subchronic and acute exposures. One of the initial steps in a risk assessment activity involves the estimation of exposure levels. These estimates are typically based on either direct environmental measurements or predictions obtained from fate and transport models. The decision to develop assessment of risk from chronic exposure based on a nonthreshold model is made if a chemical demonstrates carcinogenic activity in animal bioassays and/or in human epidemiological studies. In the absence of any positive human epidemiologic data, it is assumed that a substance which induces a statistically significant carcinogenic response in animals has the probability to cause cancer in humans. The carcinogenic potential of 2,3,7,8-TCDD has been established based on chronic exposure in rodents. In addition, 2,3,7,8-TCDD has also been shown to be a liver cancer promoter in rodents. In the risk assessment on dioxins based on chronic exposure in experimental animals, 2,3,7,8-TCDD is regarded as a carcinogenic substance.

45623 (PB–90-232216/XAB) **Asbestos exposure and gastrointestinal malignancy review and meta-analysis.** Frumkin, H.; Berlin, J. Harvard Univ., Boston, MA (USA). School of Public Health. ©1988. 19p. Source: NTIS, PC A03/MF A01.

Pub. in American Jnl. of Industrial Medicine, Vol. 14, 79-95(Jun 1988).

The epidemiologic literature linking asbestos exposure with gastrointestinal malignancy is reviewed. Problems in comparing studies are discussed, appropriate strategies for comparison are developed, and study results are pooled using a model which accounts for both intrastudy and interstudy variability. Stratification of cohorts by dose reveals that significant asbestos exposure, as indicated by a lung cancer standardized mortality ratio (SMR) of at least 200, is associated with an elevated gastrointestinal cancer SMR for five or six end points examined.

45624 (PB–90-232265/XAB) **Biochemical effects of three chlorinated phenols in rat liver.** Kitchin, K.T.; Brown, J.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. ©1988. 10p. (EPA–600/J-88/522). Source: NTIS, PC A02/MF A01.

Pub. in Toxicological and Environmental Chemistry, Vol. 16, 165-172(Feb 1988).

The hepatic biochemical effects of four chlorinated oxygen containing environmental contaminants were determined. Two oral doses of 1/5 the LD50 of 2,4-dichlorophenoxyacetic acid, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol and 2,3,4,6-tetrachlorophenol

were given 21 and 4 hours before sacrifice to adult female rats. Although 2,4,6-trichlorophenol is a carcinogen in lifetime rodent studies, no evidence was found for DNA damage in rat liver or the white cells of rat blood. Similiarly no compound related changes were found in serum alanine aminotransferase, hepatic glutathione or cytochrome P-450 content. A dose of 193 mg/kg/day (slightly over the published rat LD50) of 2,3,4,6-tetrachlorophenol increased 5-fold the activity of hepatic ornithine decarboxylase. As 2,4,6-trichlorophenol did not damage DNA or induce hepatic ornithine decarboxylase (a marker of carcinogenic promotion) in the study, no explanation is apparent why this molecule is a carcinogen in rodent lifetime exposures and structurally related congeners are not.

45625 (PB–90-232391/XAB) **Statistical issues in epidemiologic studies of the health effects of ambient acid aerosols.** Ware, J.H.; Stram, D.O. Harvard Univ., Boston, MA (USA). School of Public Health. ©1988. 11p. Source: NTIS, PC A03/MF A01.

Pub. in the Canadian Jnl. of Statistics, Vol. 16, No. 1, 5-13(Mar 1988).

Although the ecologic effects of acid rain have been widely reported, relatively little is known about the effects of acidic air pollution on human health. Some epidemiologic and animal studies suggest, however, that acidity is an important determinant of the respiratory health effects of aerosols. The paper reviews some of that evidence and discusses its implications for the design and analysis of epidemiologic studies. Two types of exposure patterns are contrasted: peak exposures associated with air pollution episodes, and chronic exposures resulting from persistently high levels of air pollutants. Recent work on the analysis of repeated categorical outcome variables provides new methods for the analysis of episode studies. Studies of long-term exposure require comparisons among population groups, and these comparisons can be subject to the design effects characteristic of multistage sample surveys. The paper examines the implications of these design effects for epidemiologic studies. The paper also discusses the measurement errors induced by the use of outdoor measurements to quantify personal exposure, and ways to assess effects of such errors on conventional analyses of air pollution studies.

45626 (PB–90-240821/XAB) **Boron hazards to fish, wildlife, and invertebrates: A synoptic review.** Eisler, R. Patuxent Wildlife Research Center, Laurel, MD (USA). Apr 1990. 39p. (BIOLOGICAL–85(1.20)). Source: NTIS, PC A03/MF A01.

Ecological and toxicological aspects of boron (B) in the environment are reviewed, with emphasis on natural resources. Subtopics covered include environmental chemistry, background concentrations, effects, and current recommendations for the protection of living resources. Boron is not now considered essential in mammalian nutrition, although low dietary levels protect against fluorosis and bone demineralization. Excessive consumption (i.e., >1,000 mg B/kg diet, >15 mg B/kg body weight daily, >1.0 mg B/L drinking water, or >210 mg B/kg body weight in a single dose) adversely affects growth, survival, or reproduction in sensitive mammals. Boron and its compounds are potent teratogens when applied directly to the mammalian embryo, but there is no evidence of mutagenicity or carcinogenicity. Boron's unique affinity for cancerous tissues has been exploited in neutron capture radiation therapy of malignant human brain tumors. Current boron criteria recommended for the protection of sensitive species include <0.3 mg B/L in crop irrigation waters, <1.0 mg B/L for aquatic life, <5.0 mg B/L in livestock drinking waters, <30 mg B/kg in waterfowl diets, and <100 mg B/kg in livestock diets.

45627 (PB–90-873399/XAB) **Pneumoconiosis. May 1978-March 1990 (A Bibliography from the Life Sciences Collection data base). Report for May 1978-March 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 83p. Source: NTISPC N01/MF N01.

Supersedes PB–82-861881.

This bibliography contains citations concerning the lung diseases generally termed pneumoconiosis. Anthracosilicosis, asbestosis, silicosis, and byssinosis are most prominently mentioned. Chest radiography studies and pulmonary function studies are considered. Studies on human leukocyte antigen (HLA) phenotypes and their relation to the disease are also discussed. (This updated bibliography contains 180 citations, 92 of which are new entries to the previous edition.)

45628 (PB–90-873522/XAB) **Chromatography for pollution and toxicological analysis. January 1987-June 1990 (A Bibliography from the NTIS data base). Report for January 1987-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 165p. Source: NTISPC N01/MF N01.

Supersedes PB–89-857163.

This bibliography contains citations concerning research and development of chromatographic absorption processes for analysis of pollution and toxins from industry. Adsorption of compounds in an ascending molecular weight order onto such adsorbent materials as activated carbon, alumina, or silica gel is discussed with reference to performance and applications. Various air and water pollutants, wastes, and toxic materials are discussed. (This updated bibliography contains 270 citations, 162 of which are new entries to the previous edition.)

45629 (PB–90-873555/XAB) **Toxicity of fibers and fiber composites. October 1988-June 1990 (A Bibliography from the NTIS data base). Report for October 1988-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 52p. Source: NTISPC N01/MF N01.

Supersedes PB–90-851759.

This bibliography contains citations concerning the toxicity of occupational exposure to such fibers as glass, wood, cotton, carbon, fiber-reinforced plastics, and asbestos. Topics include health hazard survey reports; respiratory diseases associated with occupational exposure; and methods and equipment for the detection, control, and removal of airborne fibers. (This updated bibliography contains 71 citations, 21 of which are new entries to the previous edition.)

45630 (UBA-FB–89-118) **Chronic effects of low ecologically relevant doses of cadmium on the immunological system of rats and mice. Animal experiments to investigate the immunotoxicological effects of cadmium.** Goetz, G.; Friedberg, K.D. Umweltbundesamt, Berlin (Germany, F.R.); Heidelberg Univ., Mannheim (Germany, F.R.). Inst. fuer Pharmakologie und Toxikologie. Dec 1987. 119p. (In German). Contract UFOPLAN-Nr. 10606054. Source: Copy held by UB/TIB Hannover.

Laboratory rodents were chronically administered with ecologically relevant doses of cadmium together with their water supply. After the cessation of dosing, the cadmium levels of different organs were determined and parallel investigations carried out into the influence of cadmium exposure on the zinc, copper and iron balances, which was assessed on the basis of the organ concentrations of these elements. Further examinations were performed to find out whether and to which extent any changes caused by cadmium were reversed in the course of a wash-out observation period. Interferences with the zinc metabolism were confirmed by enzymatic methods. The question as to whether cadmium might also affect the immune reactions was examined on the basis of several immunological tests. Additionally, a number of unrelated methods for the determination of metallothioneine were developed and any difficulties arising in this connection discussed in detail. (orig.) With 13 refs., 42 tabs., 8 figs.

45631 (UBA-FB–89-140) **Quantitative assessment of risks from selected carcinogenic substances in the environment.** Wahrendorf, J.; Becher, H. Umweltbundesamt, Berlin (Germany, F.R.); Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Epidemiologie und Biometric. Aug 1989. 249p. (In German). Contract UFOPLAN-Nr. 10606067;UFOPLAN-Nr. 11606067. Source: Copy held by UB/TIB Hannover.

Quantitative risk assessments are the final aim of efforts taken in order to initiate regulatory measures. The scientific approaches to those quantitative risk assessments are outlined and explained from a practical viewpoint for the substances arsenic, benzene, nickel and radon. One chapter dealing with the relevant methodology gives a survey of dose-response analyses carried out within the scope of epidemiologic and experimental studies. Parameters serving to ascertain the effect of a substance on certain human populations are introduced and discussed in connection with

methods especially developed to evaluate those parameters. Investigations were further carried out into the availability of suitable data on the abovementioned substances and these were, if possible, used to demonstrate how quantitative risk assessments can actually be achieved. As far as arsenic, benzene and radon are concerned, the suitability of epidemiologic data for quantitative risk assessments could be proven just as well as the usefulness of the analytical procedures recommended here. The available scientific evidence on nickel suggests that quantitative risk assessments for this substance are still unlikely to lead to satisfactory results. (orig.) With 336 refs., 68 tabs., 26 figs.

45632 (UCRL–21008-Vol.1) **Evaluation of military field-water quality: Volume 1, Executive Summary.** Daniels, J.I.; Gallegos, G.M. (eds.). Lawrence Livermore National Lab., CA (USA). May 1990. 102p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90015409. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This is the first and summary volume of the nine-volume study entitled Evaluation of Military Field-Water Quality. This study is a comprehensive assessment of the chemical, radiological, and biological constituents of field-water supplied that could pose health risks to military personnel around the world; it also provides a detailed evaluation of the field-water-treatment capability of the US Armed Forces. This study identifies as being of concern three physical properties, i.e., turbidity, color, and total dissolved solids; seven chemical constituents, i.e., chloride, magnesium, sulfate, arsenic, cyanide, lindane, and metabolites of algae and associated aquatic bacteria; and over twenty types of water-related pathogenic microorganisms. It also addresses five threat agents, i.e., hydrogen cyanide, radioactivity, organophosphorous nerve agents, the trichotecene mycotoxin T-2, and lewisite. An overview of the criteria and recommendations for standards for these constituents for short- term and long-term exposure periods are presented in this volume, as are health-effects summaries for assessing the potential soldier performance degradation when recommended standards are exceeded. In addition, the existing military field-water-treatment capability is reviewed, and an abbreviated discussion is presented of the general physical, chemical, and biological qualities of field waters in geographic regions worldwide, representing potential theaters of operation for US military forces. Finally, research recommendations are outlined. 18 figs., 6 tabs.

45633 (UCRL-JC–103410) **Effects of increased CO_2 on forest response.** Shinn, J.H. Lawrence Livermore National Lab., CA (USA). May 1990. 10p. Sponsored by Environmental Protection Agency. DOE Contract W-7405-ENG-48. (CONF-900676–10: 83. annual meeting and exhibition of the Air and Waste Management Association, Pittsburgh, PA (USA), 24-29 Jun 1990). Order Number DE90015406. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document discusses our forests current response to the stress elevated CO_2. The response to direct effects and to increased variability of precipitation and temperature may be more important than the response to change in average climate. We need to be prepared for the potential effects by formulating forest management plans and government policies based on enlightened risk assessments and adequate research. 11 refs., 2 figs.

45634 Standard handbook of hazardous waste treatment and disposal. Freeman, H.M. (ed.). 1120p. McGraw-Hill Book Co., New York, NY (US) (1989).

From review in BioCycle, 30, No. 1 (Jan 1989).

The handbook has 14 chapters, that cover; Laws and regulation; Hazardous waste characteristics, quantities, and treatment capacities; Risk assessments, liability insurance, health effects, and the problem of siting; Categories of wastes that have been the objects of special attention; Minimization and recycling; Ten hazardous waste recovery processes; Physical and chemical treatment; Thermal processes; Biological processes. Land storage and disposal also receive attention, as do comprehensive hazardous waste treatment facilities, remedial action techniques and technology. Approaches to deciding between various alternative processes are discussed in the final chapter.

45635 The Superfund remedial action decision process: A review of fifty records of decision. Doty, C.B. (Oak Ridge National Lab., TN (USA)); Travis, C.C. *Journal of the Air and Waste Management Association (USA).* 39(12): 1535-1543 (Dec 1989). DOE Contract AC05-84OR21400.

Although the Superfund remedial action decision process is a complex process involving a variety of technical, political, and public health issues, the primary goal of remedial action is the protection of public health. The authors performed an in-depth analysis of 50 post-SARA Records of Decision in order to characterize the role of risk assessment in the decision-making process and determine whether decisions are being made in an effective and environmentally protective manner. The authors findings indicate that the majority of decisions to remediate Superfund sites are based on the existence of contamination per se and not on actual public health risk. Although hypothetical risk is an essential consideration, this gray area is not well-defined in the current decision-making process. The lack of assessment of the degree of risk reduction associated with the remedial alternatives evaluated and the lack of support indicating the effectiveness of the remedial alternatives selected also constitute major weaknesses in the majority of decisions. These inadequacies undermine rationales regarding the protectiveness and cost-effectiveness of the remedial alternatives selected. the fact that objectives beyond addressing public health risk are often unclear in the decision-making process also weakens rationales for cost-effectiveness.

5604 Other Environmental Pollutant Effects

45636 (AD-A–221552/3/XAB) **Bioelectromagnetic effects of the electromagnetic pulse (EMP).** Patrick, E.L.; Vault, W.L. Harry Diamond Labs., Adelphi, MD (USA). Mar 1990. 20p. (HDL-TL–90-2). Source: NTIS, PC A03/MF A01.

The public has expressed concern about the biological effects and hazards of non-ionizing electromagnetic fields produced by the electro-magnetic pulse (EMP) simulators that simulate the EMP emanating from a high-altitude nuclear explosion. This paper provides a summary of the bioelectromagnetic effects literature up through the present, describes current occupational standards for workers exposed to the EMP environment, and discusses the use of medical surveillance as it relates to the potential human health hazards associated with exposure to the EMP environment.

45637 Biological effects of extremely low-frequency and 60 hZ fields. Anderson, L.E. pp. 196-235 of Biological effects and medical applications of electromagnetic energy. Gaandhi, O.P. (ed.). Prentice Hall, Inc., Englewood Cliffs, NJ (US) (1990). DOE Contract AC06-76RL01830.

Until the last few decades, the natural background levels of atmospheric electric and magnetic fields were extremely low; however, they have since dramatically increased. The industrialization and electrification of society have resulted in the exposure of people, animals, and plants to a complex milieu of elevated electromagnetic (EM) fields that span all frequency ranges. This chapter focuses on the effects of extremely low-frequency (ELF) fields, primarily at 50 and 60 Hz, on biological systems. Although the impact of ELF exposure on humans is of primary importance and concern, many areas of biological investigation are more appropriately and efficiently conducted with cellular systems or animal models. This chapter specifically examines the biological effects of exposure to ELF EM fields observed in vitro and in vivo studies. An attempt is made to help the reader evaluate experimental results and, insofar as possible, interpret them with respect to potential health implications. An overview of current concepts and possible mechanisms is given, and possible future directions of research are discussed.

57 HEALTH AND SAFETY

Refer also to citation(s) 43779, 43781, 44387, 44388, 45324, 45581, 46330

45638 (DOE/ER/60864–1) **Committee on DOE radiation epidemiological research programs: Annual performance report, June 1, 1989–March 31, 1990.** Ellett, W.H.; Cooper, R.D. National

Academy of Sciences - National Research Council, Washington, DC (USA). 10 Apr 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER60864. Order Number DE90015642. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In response to concerns with regard to their epidemiologic research program, the Office of Energy Research, US Department of Energy (DOE) asked the National Academy of Sciences/National Research Council to establish a committee to provide advice on this program. The purpose of this committee is twofold. The first purpose is to be a source of advice to the DOE on the current status and future direction of epidemiologic research funded by the Department. A second and more immediate purpose is to provide scientific advice on how the data base collected by DOE contractors for the Department's Worker Health and Mortality Study can be made readily available to the scientific community both within and outside the Department. The latter task is not without controversy since there are a number of conflicting interests concerning the widespread sharing of these data. The interests of the workers, the government, and the scientific community must be resolved in ways that ensure confidentiality of personnel records, protect priority of initial publication for the investigators who collected the data, and allow investigators not affiliated with the DOE or the Federal Government to analyze independently the worker health and mortality data base.

45639 (ORNL/FTR–3686) **[Emergency planning for technological and natural hazards]: Foreign trip report, July 3, 1990–July 14, 1990.** Rogers, G.O. Oak Ridge National Lab., TN (USA). 24 Jul 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015768. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Information was collected on research being conducted around the world on emergency planning for technological and natural hazards. Overall research activities regarding emergency planning are not as well developed as they are in the United States. Data collected by other researchers complement that found on US disasters and in some cases fills data gaps in the US Critical experience with Chernobyl and Bhopal was reported by East and West Europeans regarding the impact of Chernobyl on emergency management effort after Chernobyl and the Armenian earthquake. The emergency management experience during the Bhopal accident in India was discussed.

58 GEOSCIENCES

Refer also to citation(s) 43865, 43913, 43936, 43955, 43993, 44248, 44329, 45189, 45201, 46333

45640 (CONF-890685–Absts.) **Continental magmatism abstracts: Bulletin 131.** New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (USA). 1989. 340p. Sponsored by American Geophysical Union; University of California; U.S. DOE Defense Programs; New Mexico Bureau of Mines and Mineral Resources; University of New Mexico; National Science Foundation; Southern Methodist University; U.S. Geological Survey. DOE Contract W-7405-ENG-36 ;AC04-76DP00789. From International Association of Volcanology and Chemistry of the Earth's Interior; Santa Fe, NM (USA); 24 Jun - 1 jul 1989. Order Number DE90015514. Source: NTIS, PC A15/MF A01 - OSTI.

This document contains abstracts on continental magmatism prepared by the International Association of Volcanology and Chemistry of the Earth's Interior. Abstracts are listed alphabetically by senior author, followed by late arrivals and an index. (KJD)

45641 (CONF-891057–Vol.1) **Proceedings of the third international symposium on borehole geophysics for minerals, geotechnical, and groundwater applications: Volume 1, Papers A–W, Pages 1-396.** Minerals and Geotechnical Logging Society (USA). [1989]. 396p. Sponsored by The Minerals and Geotechnical Logging Society. From International symposium on borehole geophysics for minerals, geotechnical, and groundwater applications; Las Vegas, NV (USA); 2-5 Oct 1989. Order Number DE90015513. Source: NTIS, PC A17/MF A01; Publications Office, Geological Society of Canada, 6001 Booth Street, Ottawa, Ontario, Canada K1A-0E8 $21.00.

The competency of monitor well completions, including the continuity of the grout, position of the seal, and location of the sand pack, is becoming increasingly important in environmental investigations. Historic petroleum industry techniques for casing completion evaluation such as cement bond logging have limited value in shallow monitor wells. Borehole geophysical density logging can evaluate these completions above and below fluid level and in steel- or PVC-cased wells due to the density contrasts among various completion conditions. Empirical measurements made in the laboratory with density probes provide information on depths of investigation and tool response for specific completion conditions. These measurements are compared with field logs for two typical well constructions. The interpretation of these logs indicates potentially significant problems with the construction of these wells and demonstrate the confidence of this technique.

45642 (GSC–P88-20) **Submersible observations off the east coast of Canada.** Piper, D.J.W. (ed.) (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)). Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. 84p. (MICROLOG–89-05418). Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

A research program was initiated in 1985 to address issues related to the exploration for and development of oil and gas off eastern Canada. A series of 65 dives were carried out by a small submersible to investigate such matters as hazards posed by iceberg scour, seismicity and sediment failure, and shelf sediment mobility. This volume presents a compilation of research papers from this program. The areas covered by the dives included the Scotian Shelf, the Grand Banks, the Labrador Shelf, Baffin Shelf, and Hudson Strait. Separate abstracts have been prepared for the six papers in this volume.

45643 (GSC–P88-20, pp. 71-81) **Submersible observations of surficial sediments and seafloor morphology on the inner Scotian Shelf.** Forbes, D.L. (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)); Boyd, R. Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

The research submersible PISCES IV was used to make direct observations of surficial materials and seafloor morphology along a 3-km track on the inner Scotian Shelf in water depths of 20-33 m. The dive provided ground-truth data to complement interpretations derived from sidescan sonar and shallow seismic records, grab samples, vibracores, and limited photographic coverage obtained using surface vessels. Another objective was to sample material forming large, symmetrical, gravel ripples and to make direct measurements of bedform dimensions. The observations were made as part of research program investigating seafloor phenomena that may affect offshore hydrocarbon development. Gravel ripples with wavelengths up to 2.8 m, formed in sand-pebble mixtures, appear to be scaled to the orbital diameter of the near-bottom motion under competent winter storm waves with mean recurrence frequencies 40 h. The ripples form narrow, quasi-parallel, isobath-normal ribbons, which may be analogous to hallow, rippled, scour depressions reported from other inner-shelf locations. Much of the adjacent seafloor is covered by an apparently stable gravel armour, with encrusting algal growth on all but the finest gravel. The surficial gravel in the study area is believed to be primarily relict beach gravel dispersed after abandonment on the shoreface to form a thin veneer over large areas of the inner shelf. Features observed include an extensive area of sand with small-scale, wave-formed ripples and cobble-boulder lags with large populations of seaweed. 28 refs., 7 figs.

45644 (GSC–P88-20, pp. 57-69) **PISCES IV submersible observations in the epicentral region of the 1929 Grand Banks earthquake.** Clarke, J.E.H. (Dept. of Oceanography, Dalhousie Univ., Halifax, NS (Canada)); Mayer, L.A.; Piper, D.J.W.; Shor, A.N. Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

The PISCES IV submersible was used to investigate the upper continental slope near the epicentre of the 1929 Grand Banks earthquake, as part of a research program investigating seafloor phenomena that may affect offshore hydrocarbon development. Four dives in water depths of 800-2000 m were undertaken to observe specific features identified with the SeaMARC I sidescan system in 1983. Two dives were made in the head of Eastern Valley where pebbly mudstones of probable Pleistocene age were recognized outcropping on the seafloor. Constructional features of cobbles and boulders, derived by exhumation and reworking of the pebbly mudstone, were also observed. These include gravel/sand bed forms (transverse waves) on the valley floor. Slope failure features in semiconsolidated mudstone were recognized on two dives onto the St. Pierre slope. Exposures in these mudstones are rapidly eroded by intense burrowing by benthic organisms. 12 refs., 18 figs.

45645 (GSC–P88-20, pp. 41-56) **Submersible observations on the Labrador Shelf, Hudson Strait and Baffin Shelf.** Josenhaus, H.W. (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)); Barrie, J.V. Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

Observations were made from 19 submersible dives on the Labrador and southern Baffin Shelves, as part of a research program investigating seafloor phenomena that may affect offshore hydrocarbon development. The dives document three newly formed iceberg scour marks in different sediment types and allow for interpretations of scour mark formation. One of these scour marks was investigated only 10 days after the grounded iceberg drifted off the impact site. Rates of seabed change over time were estimated by documenting features of known age. The rate of iceberg scour mark erosion was estimated at one locality where a 6 year old scour had been crosscut by another scour which is believed to have formed within weeks of the inspection. One metre of berm erosion in 6 years was measured. All dives on the shelf areas indicate frequent and substantial reworking by the iceberg scouring process and subsequent rapid erosion by a combination of biogenic reworking and removal of the fine sediments by local bottom currents. Evidence on the bank tops in water depth less than 150 m indicates a dominantly erosional setting. One dive completed at the upper slope of the central Labrador Shelf between a depth of 1000 and 650 m indicated modern mass wasting and a recently formed debris flow. Some of the slope failure was triggered by ice-rafted debris. A dive off Hudson Strait between 1000 and 750 m (below the maximum depth of iceberg scouring) indicated furrowing and raking of the seabed in a contour parallel direction by some mechanism which is not understood at this time. 11 refs., 11 figs.

45646 (GSC–P88-20, pp. 27-39) **Submersible observations of iceberg furrows and sand ridges, Grand Banks of Newfoundland.** Fader, G.B.J. (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)). Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

Iceberg furrows and sand ridges at the seabed on the Grand Banks of Newfoundland have been studied to better understand processes which modify surficial Quaternary sediments, as part of a research program investigating seafloor phenomena that may affect offshore hydrocarbon development. Observations were made from the submersible PISCES IV. Iceberg furrows and pits, exhibiting relief of up to 12.5 m, cover the seabed of the Avalon Channel and appear to be relict and coeval. They are developed within glacial till of the Grand Banks Drift formation. Postglacial ice-rafting appears to play a minor role as a sedimentation mechanism. The troughs of the iceberg furrows consist of well-sorted, pebble- to cobble-sized, angular clasts, in contrast to the flanking berms which are composed entirely of boulders. Sand ridges of the Grand Banks Sand and Gravel formation occur across most of the surface of Grand Bank. Complex, broad sinuous areas of megarippled coarse sand and fine gravel are incised and eroding into the ridge surfaces. The ridges overlie a basal gravel lag deposit which outcrops in the troughs of the sand ridges. This gravel consists of pebble- to large boulder-sized material, most of which is subrounded to rounded. The distribution and shape of the gravel within the ridge troughs implies that the gravel originated pricipally through the action of glaciers that extended across the entire Grand Banks of Newfoundland and not through ice-rafting. 12 refs., 13 figs.

45647 (GSC–P88-20, pp. 9-26) **Submersible observations of Quaternary sediments and bedforms on the Scotian Shelf.** Amos, C.L. (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)). Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

A complex sequence of unconsolidated sediments underlies much of the middle and outer Scotian Shelf, Canada. Parts of this sequence outcrop along the eroded bank edges. These were examined during dives in the submersible PISCES IV during a research program investigating seafloor phenomena that may affect offshore hydrocarbon development. The resulting observations were compared with high-resolution seismic reflection profiles and side scan sonograms. Bedrock cliffs and terraces, postulated to occur on the west and northeast flanks of the gully, were seen and corresponded with a seismic reflection discontinuity which has been traced under much of Sable Island Bank. The distribution and classification of shelf bedforms had been previously based largely on side scan sonograms and so their true nature and origin were in doubt. Observations of these bedforms verified interpretations of acoustic data. Bedform migration directions measured south of Sable Island support an eastward net transport of sand. The spillover of this sand from eastern Sable Island Bank into the gully was not apparent. However, sediment slumps and active grain flows were seen in Canyon 48, indicating a transfer of material to deeper water by the trapping of sand in canyon heads. 31 refs., 12 figs., 1 tab.

45648 (GSC–P88-20, pp. 3-7) **The 1985 Atlantic Geoscience Centre PISCES IV submersible program: introduction.** Piper, D.J.W. (Atlantic Geoscience Centre, Bedford Inst. of Oceanography, Darmouth, NS (Canada)). Geological Survey of Canada, Ottawa, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1989. (MICROLOG–89-05418). In *Submersible observations off the east coast of Canada.* Source: PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN.

In 1985, 65 dives of the submersible PISCES IV were made on geoscientific targets off the east coast of Canada. Dives were carried out principally to investigate sediment transport processes in

fiords, on the continental shelf, and on the continental slope and to address other issues related to oil and gas development, such as hazards posed by iceberg scour and seismicity. The results of the diving programs are summarized. The submersible facilitated detailed site investigations, including precision sampling, of sea bed features whose small size made investigation from a surface ship very difficult or impossible. The 1985 program significantly improved understanding of such phenomena as the Scott Trough oil seep, prodelta instability features in Baffin fiords, and iceberg scour degradation on the Labrador Shelf. It also increased confidence in the interpretation of sidescan sonar images, providing needed quantitative calibration. 29 refs., 1 fig., 1 tab.

45649 (LBL–24910) **CHANGE: A numerical model for three-dimensional modelling of channelized flow in rock: Theory and design.** Billaux, D.; Long, J.C.S.; Peterson, J.E. Jr. Lawrence Berkeley Lab., CA (USA). Mar 1990. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016631. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A model for channelized flow in three-dimensional, random networks of fractures has been developed. In this model, the fractures are disc-shaped discontinuities in an impermeable matrix. Within each fracture, flow occurs only in a network of random channels. The channels in each fracture can be generated independently with random distributions of length, conductivity, and orientation in the fracture plane. Boundary conditions are specified on the sides of a "flow region," and at the intersections of the channels with interior "holes" specified by the user to simulate boreholes or drifts. This code is part of a set of programs used to generate two-dimensional or three-dimensional random fracture networks, plot them, compute flow through them and analyze the results. 8 refs., 13 figs.

45650 (LBL–24911) **CHANGE: A numerical model for three-dimensional modelling of channelized flow in rock: User's manual and listing.** Billaux, D.; Peterson, J.E. Jr. Lawrence Berkeley Lab., CA (USA). Mar 1990. 95p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016620. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The purpose of this report is to provide the user with sufficient information to run the program CHANGE: A numerical model for three-dimensional modelling of channelized flow in rock. This report should familiarize the user with program options and modes of operation, input variables, input and output files. In addition, information not strictly needed to run the program, but useful in understanding its internal structure and the flow of computation is provided in the appendices. The appendices cover program variables and arrays, subroutines outlines, a short description of each subroutine, and finally a listing of the code. 7 refs., 4 tabs.

45651 (LBL–26594) **Network modelling of flow in natural fractures.** Yang, Gemei; Cook, N.G.W.; Myer, L.R. Lawrence Berkeley Lab., CA (USA). Jun 1989. 8p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-890628–13: 30. US symposium on rock mechanics, Morgantown, WV (USA), 19-22 Jun 1989). Order Number DE90015310. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The void space between the two surfaces of a fracture was simulated using a stratified percolation model, based on a fractal distribution of apertures. Local apertures were treated as tubes with elliptical cross-sections, to determine their hydraulic resistance for use in a network model. This results in a network of highly inhomogeneous resistances. A search technique was used to remove dead-ends and dead loops. The Hardy-Cross method was used to solve for flow. Correlation inherent in the model generates clusters of high apertures separated by areas of contact. Critical segments through areas of contact establish percolation between areas of high apertures. 13 refs., 3 figs.

45652 (LBL–28818) **Sensitivity studies on parameters affecting gas release from an underground rock cavern.** Schlueter, E.; Pruess, K. Lawrence Berkeley Lab., CA (USA). Jan 1990. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016632. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

A series of numerical simulation experiments is performed to quantify the effects of the release and migration of non-condensible gas in water-saturated fractured rock formations. The relative importance of multiphase parameters such as relative permeability, capillary pressure, intrinsic permeability, and porosity on system behavior is studied. 10 refs., 28 figs., 5 tabs.

45653 (LBL–28938) **Integral solutions for transient fluid flow through deformable media.** Wu, Yu-Shu; Pruess, K.; Witherspoon, P.A. Lawrence Berkeley Lab., CA (USA). Apr 1990. 42p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016643. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents an integral method for analyzing transient fluid flow through a deformable porous medium. Approximate analytical solutions have been obtained for one-dimensional linear and radial flow by the integral technique, in which the density of the fluid, and the porosity and permeability of the formation are treated as arbitrary functions of pressure. The integral solutions have been checked by comparison with exact solutions for the linear case, and with numerical simulation results for general non-linear problems; excellent agreement has been obtained. In the study of transient flow of fluids through porous media, permeability of the formation has often been treated as a constant in order to avoid solving a non-linear problem. The present work shows that the assumption of pressure-independent permeability may introduce significant errors for flow in deformable media. Application of the integral solutions to slightly compressible fluid flow in a horizontal fracture network is illustrated. The calculations show that neglect of changes in fracture permeability leads to large errors when injection pressure in high. 24 refs., 12 figs., 2 tabs.

45654 (LBL–29203) **Coupled stiffness-permeability analysis of a single rough surfaced fracture by the three-dimensional boundary element method.** Chen, Di-Wen. Lawrence Berkeley Lab., CA (USA). May 1990. 181p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90015692. Source: NTIS, PC A09/MF A01 - OSTI; GPO Dep.

An understanding of the mechanical and hydraulic properties of fractures has become increasingly important in various problems, particularly those involving underground waste isolation and production from fractured oil reservoirs. A typical fracture consists of asperity regions where the two rock surfaces are in contact, surrounded by regions where the two surfaces are separated by an aperture that may vary from point to point. When fluid flows through such a fracture, it not only must flow around the contact areas, but also has a tendency to preferentially flow through the channels with the largest apertures, since hydraulic conductance is locally proportional to the aperture cubed. The permeability therefore depends on the amount of contact area, the spatial distribution of the contact areas, as well as the aperture. All of these parameters are, functions of the stress to which the fracture is subjected. The two aspects of my analysis using a boundary element techniques are to compute separately the tortuosity and the stiffness induced by the contact area and to compute hydromechanical coupling between stress, stiffness, and hydraulic conductivity of fractures. For the hydromechanical coupling, I start by generating fractures with random aperture distributions, and which have a certain of statistical correlation between the aperture at different locations. I determine the relationship between normal stress, average aperture, joint stiffness, and permeability. These simulations should provide insight into the coupled hydromechanical behavior of fractures. If realistic aperture distributions can be found, this procedure could be used to predict permeability and stiffness. 40 refs., 70 figs., 21 tabs.

45655 (LBL–29235) **Characterization of leaky faults.** Shan, Chao. Lawrence Berkeley Lab., CA (USA). May 1990. 201p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. Order Number DE90015300. Source: NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

Leaky faults provide a flow path for fluids to move underground. It is very important to characterize such faults in various engineering projects. The purpose of this work is to develop mathematical solutions for this characterization. The flow of water in an aquifer system and the flow of air in the unsaturated fault-rock system

were studied. If the leaky fault cuts through two aquifers, characterization of the fault can be achieved by pumping water from one of the aquifers, which are assumed to be horizontal and of uniform thickness. Analytical solutions have been developed for two cases of either a negligibly small or a significantly large drawdown in the unpumped aquifer. Some practical methods for using these solutions are presented. 45 refs., 72 figs., 11 tabs.

45656 (NCGS/BULL–92) **Geology of the Southeast Durham and Southwest Durham 7.5-minute Quadrangles, North Carolina.** Hoffman, C.W.; Gallagher, P.E. North Carolina Dept. of Natural Resources and Community Development, Raleigh, NC (USA). Div. of Land Resources. 1989. 34p. Sponsored by North Carolina Geological Survey. Source: OSTI; Geological Survey Section, P.O. Box 27687, Raleigh, NC 27611-7687.

The Southeast Durham and Southwest Durham 7.5-minute Quadrangles include a 26 kilometer transect of the Durham Triassic basin from the Jonesboro fault on the southeastern side of this half-graben structure to a bounding unconformity on the northwestern side. The basin is filled with non-marine, primarily fluvial, clastic deposits of the Late Triassic Chatham Group. The Chatham Group rocks are intruded by Early Jurassic diabase as dikes and sheets. Bordering rocks are pre-Mesozoic intrusive, metavolcanic and metasedimentary rocks of the Carolina slate belt. This paper discusses the geology of the Southeast Durham and Southwest Durham Quadrangles. 37 refs., 17 figs.

45657 (PB–90-223926/XAB) **Centrifuge modeling of large ground motions and their effects on structures.** Steedman, R.S. Cambridge Univ. (UK). Dept. of Engineering. 1989. 19p. (CUED/D-SOILS/TR–229). Source: NTIS, PC EE06/MF E06.

Physical modeling of soil-structure interaction under earthquake loading in a geotechnical centrifuge has advanced to a stage where specific design problems can be addressed. The paper discusses the data of centrifuge model tests showing the onset of softening, large ground motions and liquefaction observed around a long anchored quay wall which led to the failure of the structure. This class of failure, similar to that observed at Akita Port during the Nihonkai-Chubu earthquake of 1983, is explained and the sequence of events described. Analysis of the soil-structure system shows how the high overall stiffness of long structures embedded in the ground deteriorates in the presence of high excess pore pressures and this leads to dynamic effects and failure coincident with, rather than as a result of, liquefaction around the structure. The effects of pore pressure migration are considered and the implications for the physical modeling of field problems subject to earthquake loading are discussed.

45658 (PB–90-231226/XAB) **Subsea permafrost: Probing, thermal regime and data analyses 1975-1981. Summary report (Final).** Osterkamp, T.E.; Harrison, W.D. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. Apr 1985. 111p. (UAG-R–301). Source: NTIS, PC A06/MF A01.

This is the summary report of a program to study the distribution and properties of subsea permafrost in Alaskan waters. More specifically, the objectives have been– to obtain reconnaissance level information on subsea permafrost conditions over a wide geographic area, to investigate conditions at the sea bed relevant to the evolution of the underlying permafrost regime, and to study the heat and salt transport processes in subsea permafrost with the eventual goal of predicting its response to natural or man-induced conditions. The field measurements have included soil type, temperature, electrical conductivity of the soil pore water, thermal and hydraulic conductivity, in-situ ice detection, and pore water pressure. In the last few years, subsea permafrost data have been obtained by the petroleum industry as part of geotechnical investigations for offshore pipelines and structures. Most of the information is proprietary, and the data obtained by the OCSEAP and USGS programs still comprise the bulk of what is in the public domain.

45659 (PB–90-241738/XAB) **Diffusion of helium isotopes in silicate glasses and minerals: Implications for petrogenesis and geochronology. Doctoral thesis.** Trull, T.W. Woods Hole Oceanographic Institution, MA (USA). Jun 1989. 404p. (WHOI–89-15). Source: NTIS, PC A18/MF A03.

Helium diffusivities in basaltic glasses at seafloor temperatures are about 10 to the -16th power sq cm/s suggesting only very low concentration samples will be compromised, and that U/He geochronology of submarine basalts may be feasible. Helium diffusivities at magmatic temperatures are 10 to the -11th power, to 10 to the -8th power sq cm/s in silicate minerals, too low to regionally homogenize helium in the mantle. Helium exchange rates limit xenolith origin depths and transport times. Faster He diffusion in pyroxene than olivine allows diffusive loss to be evaluated. Diffusivities of ^3He produced by cosmic rays in surface rocks are less than 10 to the -20th power sq cm/s in olivine and quartz, suggesting exposure dating will not be limited by helium loss for ages up to 10,000,000 years. Similar conclusions were found for $U/^4He$ dating of quartz. Part of the $^3He/^4He$ variability (.01 to 9 R_a) of island arc basalts from the western Pacific reflects post-eruptive helium addition. In unaltered samples, Kavachi submarine volcano has different $^3He/^4He$ (6.9 + or - .2 R_a) than the Woodlark Spreading Center (8-9 R_a). A contribution from subducted Pacific lithosphere may explain this and 87 Sr/86 Sr variations.

45660 (SAND–90-1317) **Measuring the dynamic compression and release behavior of the Paintbrush and Tunnel Bed (NTS) Tuffs over the range 1–13 GPa.** Furnish, M.D. Sandia National Labs., Albuquerque, NM (USA). Aug 1990. 79p. Sponsored by U.S. Department of Defense. DOE Contract AC04-76DP00789. Order Number DE90014864. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

High pressure Hugoniot and release equation of state data are provided for samples from three Nevada Test Site rock units. These are the MC-2 and MC-3 members of the P-Tunnel (Paintbrush) Tuff and the N-Tunnel (Tunnel Bed) Tuff. The technique used provides continuous release trajectories from the Hugoniot pressure down to approximately half of the Hugoniot pressure. Hugoniot and release results for the MC-2 and MC-3 members are very similar, while the Hugoniot of the N-Tunnel Tuff is somewhat stiffer, consistent with the higher density of this tuff as tested. The materials were tested at less than full saturation; correcting for this tends to narrow the difference in the properties of the two rock types sufficiently that the data do not provide a basis for predicting significantly different groundshock properties of the three units, leaving unexplained the anomalously high groundshock attenuation observed in the Mission Cyber event (performed in the MC-2 unit of the Paintbrush tuff). 26 refs., 61 figs., 9 tabs.

45661 (UCRL-CR–104533) **Lawrence Livermore Laboratory (LLL) gravity work for the Hawaiian Volcano Observatory.** Goodkind, J.M. Lawrence Livermore National Lab., CA (USA). 5 May 1990. 5p. Sponsored by National Oceanic and Atmospheric Administration. DOE Contract W-7405-ENG-48. Order Number DE90015816. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this funding has been to install two modified UCSD superconducting gravimeters at the Hawaiian Volcano Observatory (HVO). The research and development underlying the modifications was funded primarily by NOAA and in smaller part by this contract. Modification and installation of the instruments at HVO could not proceed prior to completion of this effort. Although considerable work remains to be done to guarantee optimum performance of all future instruments, three instruments have been assembled using present technology and their performance meets our most optimistic expectations. No instrumental drift has been measurable on them and current results allow us to set an upper limit on drift at about 0.5 μGal for a five month record at Miami. As longer simultaneous records from two instruments are obtained this limit will be set lower. They reveal substantial gravity variations due to rainfall as well as smaller ones which may be caused by activity within the volcano. 2 refs., 1 fig.

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45662 (JINR–7-33-88) **JINR rapid communications: Collection.** Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 70p. Order Number DE90706118. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Individual papers in this collection are indexed separately.

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Refer also to citation(s) 45100, 45169, 45807, 45813, 45873, 45898

45663 (AD-A–221006/0/XAB) **Study of the interplanetary disturbances on 1-4 April 1979.** Akasofu, S.I.; Lee, L.H. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. 1988. 9p. (SCIENTIFIC–2). Source: NTIS, PC A02/MF A01.

Pub. in Planet, Space Sci., Vol. 36, No. 7, 669-675(1988).

Three interplanetary shock events during the first week of April 1979 are modeled by the method developed originally by Hakamada and Akasofu (1982). There occurred a large number of weak and medium intensity solar flares during this period. However, solar wind observations at three points, the Earth (ISEE-3), Helios A and B, enables us to choose three solar flares and their parameters in such a way that the simulated arrival times and the speed jumps of the shock waves at the three points are in fair agreement with the observations.

45664 (AD-A–221188/6/XAB) **Mechanism for the formation of plasmoids and kink waves in the heliospheric current sheet.** Wang, S.; Lee, L.C.; Wei, C.Q.; Akasofu, S.I. Alaska Univ., College, AK (USA). 18 Sep 1987. 14p. (SCIENTIFIC–1). Source: NTIS, PC A03/MF A01.

Satellite observations of the heliospheric current sheet indicate that the plasma flow velocity is low at the center of the current sheet and high on the two sides of current sheet. In this paper, we investigate the growth rates and eigenmodes of the sausage, kink, and tearing instabilities in the heliospheric current sheet with the observed sheared flow. These instabilities may lead to the formation of the plasmoids and kink waves in the solar wind. The results show that both the sausage and kink modes can be excited in the heliospheric current sheet with a growth time about 0.05-5 day. Therefore, these modes can grow during the transit of the solar wind from the Sun to the Earth. The sausage mode grows faster than the kink mode for beta at infinity < 1.5, while the streaming kink instability has a higher growth rate for beta at infinity > 1.5. Here beta at infinity is the ratio between the plasma and magnetic pressures away from the current layer. If a finite resistivity is considered, the streaming sausage mode evolves into the streaming tearing mode with the formation of magnetic islands. We suggest that some of the magnetic clouds and plasmoids observed in the solar wind may be associated with the streaming sausage instability. Furthermore, it is found that a large-scale kink wave may develop in the region with a radial distance greater than 0.5-1.5 AU.

45665 (CSNSM-T–89-51) **New method of the ^{17} O + p reaction rate determination by means of the measurement of the partial widths of ^{18} F levels. Consequences on the oxygen isotopes abundance ratio of red giant stars.** Landre, V. Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse; Paris-7 Univ., 75 (France). 1989. 235p. (In French). Order Number DE90514609. Source: NTIS (US Sales Only), PC A11/MF A01.

The ^{17} O destruction by the CNO cycle in the ^{17} O (p, α) ^{14} N and ^{17} O(p, γ) ^{18} F reactions is studied. The consequences on the isotropic abundance ratio at the surface of some red giants and supergiants, with mass values about 2 and 15 of the solar mass, are discussed. The results of the energy measurements of the first level and above the threshold value of ^{17} O + p are reported, as well as the tranfer reaction formulation. The utilization of the new reaction ratio in the evolution and stellar nucleosynthesis is explained. The results are in good agreement with the most part of the observations performed.

45666 (DOE/ER/40380–2, pp. 80-86) **Observations of ultra high energy emission from CYGNUS X-3.** Keppel, C. (American Univ., Washington, DC (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The CYGNUS experiment, consisting of an extensive air shower detector and a muon detector, was built at Los Alamos National Laboratory to search for point sources of extremely high energy particles. These ultra high energy signals must be produced by long-lived neutral particles because of the source distance and intragalactic magnetic fields. Gamma rays are the most likely candidates due to the short neutron lifetime and the small neutrino cross section. The muon content of gamma-initiated showers is expected to be small. 1 ref., 2 figs.

45667 (KEK–89-22, pp. 261-272) **(2+1)-dimensional gravity with the cosmological constant.** Fujiwara, Yoshihisa (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics); Soda, Jiro. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

The (2+1)-dimensional Einstein gravity with a cosmological constant is studied in the ADM canonical formalism. Adopting the York's time slice, we completely solve the initial-value problem and the time evolution equations with an initial spacelike 2-surface being a closed Riemann surface of genus one. The result is that the Teichmueller parameters for the torus follow a geodesic in the Teichmueller space but its motion asymptotically stops due to the presence of the cosmological constant. (author).

45668 (KEK-PR–89-2) **Status reports of supercomputing astrophysics in Japan.** Nakamura, Takashi; Nagasawa, Mikio (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). 1990. 412p. (CONF-8908246–: Workshop on supercomputing astrophysics, Tsukuba (Japan), 31 Aug - 2 sep 1989). Order Number DE90513793. Source: NTIS (US Sales Only), PC A18/MF A01.

The Workshop on Supercomputing Astrophysics was held at National Laboratory for High Energy Physics (KEK, Tsukuba) from August 31 to September 2, 1989. More than 40 participants of physicists, astronomers were attendant and discussed many topics in the informal atmosphere. The main purpose of this workshop was focused on the theoretical activities in computational astrophysics in Japan. It was also aimed to promote effective collaboration between the numerical experimentists working on supercomputing technique. The various subjects of the presented papers of hydrodynamics, plasma physics, gravitating systems, radiative transfer and general relativity are all stimulating. In fact, these numerical calculations become possible now in Japan owing to the power of Japanese supercomputer such as HITAC S820, Fujitsu VP400E and NEC SX-2. (J.P.N.).

45669 (LA-UR–90-2374) **The impact of IUE on studies of the nova outburst: 1986–1990.** Starrfield, S. (Arizona State Univ., Tempe, AZ (USA). Dept. of Physics). Los Alamos National Lab., NM (USA). [1990]. 34p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-9005248–4: Evolution in astrophysics: IUE astronomy in the era of new space missions, Toulouse (France), 29 May - 1 jun 1990). Order Number DE90014915. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this review I will concentrate on the improvements in our understanding of the nova outburst that have occurred since the IUE meetings in London in 1986 and Goddard in 1988 and those results that have occurred as a direct result of studies with the IUE satellite. These involve the four outbursts that have occurred in the LMC, the numerous recurrent novae outbursts, and a number of archival studies. As a direct result of IUE studies done since 1986, we can now state that fast novae become super-Eddington at maximum, that many novae decline at the same rate, and that neon novae may be more numerous than thought previously. In addition, we have found that there are differences in the outburst characteristics between novae with giant secondaries and those with compact secondaries. 18 refs., 11 figs., 1 tab.

45670 (LBL–29101) **Fast pulsars, strange stars: An opportunity in radio astronomy.** Glendenning, N.K. Lawrence Berkeley Lab., CA (USA). 15 Jul 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900495–1:

Annual meeting of the Division of Physics of Beams of the American Physical Society; 199. national meeting of the American Chemical Society, Washington, DC (USA); Boston, MA (USA), 16-19 Apr 1990; 22-27 apr 1990; CONF-900402--8). Order Number DE90015630. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The world's data on radio pulsars is not expected to represent the underlying pulsar population because of a search bias against detection of short periods, especially below 1 ms. Yet pulsars in increasing numbers with periods right down to this limit have been discovered suggesting that there may be even shorter ones. If pulsars with periods below 1/2 ms were found, the conclusion that the confined hadronic phase of nucleons and nuclei is only metastable would be almost inescapable. The plausible ground state in that event is the deconfined phase of (3-flavor) strange-quark-matter. From the QCD energy scale this is as likely a ground state as the confined phase. We show that strange matter as the ground state is not ruled out by any known fact, and most especially not by the fact that the universe is in the confined phase. 136 refs.

45671 (LYCEN–89-02 C.13.1-C.13.27) **Nuclear physics from SN1987A.** Schaeffer, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Theorique). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172--: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

SN1987A, in the Large Magellanic cloud, was the closest supernova since the 1604 event observed by Kepler. It provided a unique opportunity to verify our theories and comfort our beliefs in quite a variety of domains: Nuclear Physics (Neutron star formation, Equation of state under extreme conditions, Nucleosynthesis), Particle physics (Neutrino properties) and Astrophysics (Stellar evolution, conditions prevailing at the star's explosion). All these observations strongly confirm our previous ideas on the physical conditions prevailing during the supernova explosions, although the SN1987A event was not exempt of surprises.

45672 (N–90-22426) **Big-bang nucleosynthesis revisited.** Olive, K.A.; Schramm, D.N.; Steigman, G.; Walker, T.P. Fermi National Accelerator Lab., Batavia, IL (USA). Dec 1989. 14p. (NASA-CR–186256;NAS–1.26:186256;FERMILAB-PUB–89/262-A;CFA–89-2985;UMN-TH–816/89). Source: NTIS, PC A03/MF A01.

The homogeneous big-bang nucleosynthesis yields of D, He-3, He-4, and Li-7 are computed taking into account recent measurements of the neutron mean-life as well as updates of several nuclear reaction rates which primarily affect the production of Li-7. The extraction of primordial abundances from observation and the likelihood that the primordial mass fraction of He-4, Y_p is less than or equal to 0.24 are discussed. Using the primordial abundances of D + He-3 and Li-7 we limit the baryon-to-photon ratio (eta in units of 10 exp -10) 2.6 less than or equal to eta_{10} less than or equal to 4.3; which we use to argue that baryons contribute between 0.02 and 0.11 to the critical energy density of the universe. An upper limit to Y_p of 0.24 constrains the number of light neutrinos to N_{nu} less than or equal to 3.4, in excellent agreement with the LEP and SLC collider results. We turn this argument around to show that the collider limit of 3 neutrino species can be used to bound the primordial abundance of He-4: 0.235 less than or equal to Y_p less than or equal to 0.245.

45673 (N–90-22467, pp. 9) **Does mass accretion lead to field decay in neutron stars.** Shibazaki, N. (Tokyo Univ. (Japan)); Murakami, T.; Shaham, J.; Nomoto, K. Columbia Univ., New York, NY (USA). Nov 1989. (NASA-CR–186002;NAS–1.26:186002;CAL–1793). In *Physics of systems containing neutron stars.* Source: NTIS, PC A03/MF A01.

The recent discovery of cyclotron lines from gamma-ray bursts indicates that the strong magnetic fields of isolated neutron stars might not decay. The possible inverse correlation between the strength of the magnetic field and the mass accreted by the neutron star suggests that mass accretion itself may lead to the decay of the magnetic field. The spin and magnetic field evolution of the neutron star was calculated under the hypothesis of the accretion-induced field decay. It is shown that the calculated results are consistent with the observations of binary and millisecond radio pulsars.

45674 (N–90-22510) **An astrophysics data program investigation of cluster evolution. Semiannual report No. 1, 1 August 1989-31 January 1990.** Kellogg, E.M. Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory. Jun 1990. 25p. (NASA-CR–181296;NAS–1.26:181296). Source: NTIS, PC A03/MF A01.

A preliminary status report is given on studies using the Einstein x ray observations of distant clusters of galaxies that are also candidates for gravitational lenses. The studies will determine the location and surface brightness distribution of the x ray emission from clusters associated with selected gravitational lenses. The x ray emission comes from hot gas that traces out the total gravitational potential in the cluster, so its distribution is approximately the same as the mass distribution causing gravitational lensing. Core radii and x ray virial masses can be computed for several of the brighter Einstein sources, and preliminary results are presented on A2218. Preliminary status is also reported on a study of the optical data from 0024+16. A provisional value of 1800 to 2200 km/s for the equivalent velocity dispersion is obtained. The ultimate objective is to extract the mass of the gravitational lens, and perhaps more detailed information on the distribution of matter as warranted. A survey of the Einstein archive shows that the clusters A520, A1704, 3C295, A2397, A1722, SC5029-247, A3186 and A370 have enough x ray counts observed to warrant more detailed optical observations of arcs for comparison. Mass estimates for these clusters can therefore be obtained from three independent sources: the length scale (core radius) that characterizes the density dropoff of the x ray emitting hot gas away from its center, the velocity dispersion of the galaxies moving in the cluster potential, and gravitational bending of light by the total cluster mass. This study will allow the comparison of these three techniques and ultimately improve the knowledge of cluster masses.

45675 (PB–90-214487/XAB) **Synthesis and inversion of Stokes spectral profiles. Thesis.** Murphy, G.A. National Center for Atmospheric Research, Boulder, CO (USA). 1990. 341p. (NCAR/CT–124). Source: NTIS, PC A15/MF A02.

Observations of Stokes spectral profiles enable the magnetic fields on the Sun's surface to be determined. Inversion is the process whereby the profiles are reduced to magnetic field vectors. One of the most robust, accurate and rapid methods available for inversion uses the least-squares fitting of analytical Stokes profiles. As this technique is suitable for the automated reduction of large sets of data, it has been adopted for use with the Advanced Stokes Polarimeter, presently under development. The limitations of inversion by analytical profile fitting have not been firmly established. Confident analysis of magnet field vectors depends upon the precise interpretation of reduced data. In this work, a framework is introduced which allows such an assessment to be made. The magnetofluid-static sunspot models presented here provide a self-consistent range of physical conditions similar to those in sunspots. Inversion can then be carried out on Stokes profiles synthesized from these known realistic conditions. The capabilities of an inversion technique can be evaluated by comparison between the models and the deduced values.

45676 (PB–90-226028/XAB) **Solar-Geophysical Data Number 548, April 1990. Part 1 (prompt reports). Data for March, February 1990, and late data.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Apr 1990. 160p. (SGD–548-PT-1). Source: NTIS, PC A08/MF A01.

See also PB–90-208877.

Contents: detailed index for 1989-1990; data for March 1990–solar-terrestrial environment, IUWDS alert periods (advance and worldwide), solar activity indices, solar flares, solar radio emission, stanford mean solar magnetic field; data for February 1990–solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, geomagnetic indices; late data–solar radio emission February 1990, cosmic rays climax and huancayo January 1990, inferred

interplanetary magnetic field 1989, printer's error November-December 1989 data–reprint of halftone images of kitt peak solar magnetic field synoptic charts rotations 1822-1823.

45677 (PB–90-226036/XAB) **Solar-Geophysical Data Number 548, April 1990. Part 2 (comprehensive reports). Data for October 1989 and miscellaneous.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Apr 1990. 99p. (SGD–548-PT-2). Source: NTIS, PC A05/MF A01.

See also PB–90-208885.

Contents: detailed index for 1989-1990; data for October 1989–solar flares, solar radio bursts at fixed frequencies, solar x-ray radiation from goes satellite, mass ejections from the sun, active prominences and filaments; miscellaneous data–meudon carte synoptique..carrington rotation 1819 August 1989, active regions and filaments, synoptic solar map.

45678 (PB–90-233214/XAB) **Neutron viscosity in accretion disks.** Guessoum, D.; Kazanas, D. National Aeronautics and Space Administration, Greenbelt, MD (USA). Lab. for High Energy Astrophysics. Nov 1989. 44p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

The authors examine the possibility of neutron viscosity as the mechanism responsible for the dissipation of kinetic energy into luminosity in the innermost parts (r < 100 R sub s) of accretion disks surrounding compact objects. They present simplified models of such self-consistent, steady state accretion flows in which the viscosity is provided by neutron collisions with the accreting ions. Their results indicate that neutrons can indeed provide the necessary dissipation to sustain the steady state accretion of matter, and thus present a promising way of modeling the bright galactic X-ray sources such as Cyg X-1.

45679 (PB–90-233305/XAB) **Acceleration by pulsar winds in binary systems.** Harding, A.K.; Gaisser, T.K. National Aeronautics and Space Administration, Albuquerque, NM (USA). Lab. of High Energy Astrophysics. 30 Jan 1990. 43p. Source: NTIS, PC A03/MF A01.

Also available from Supt. of Docs.

In the absence of accretion torques, a pulsar in a binary system will spin down due to electromagnetic dipole radiation and the spin-down power will drive a wind of relativistic electron-positron pairs. Winds from pulsars with short periods will prevent any subsequent accretion but may be confined by the companion star atmosphere, wind or magnetosphere to form a standing shock. The authors investigate the possibility of particle acceleration at such a pulsar wind shock and the production of VHE and UHE gamma rays from interactions of accelerated protons in the companion star's wind or atmosphere. They find that in close binaries containing active pulsars, protons will be shock accelerated to a maximum energy dependent on the pulsar spin-down luminosity. If a significant fraction of the spin-down power goes into particle acceleration, these systems should be sources of VHE and possibly UHE gamma rays. The authors discuss the application of the pulsar wind model to binary sources such as Cygnus X-3, as well as the possibility of observing VHE gamma-rays from known binary radio pulsar systems.

45680 (RRK–90-05) **Microwave background anisotropies and the primordial spectrum of cosmological density fluctuations.** Suto, Yasushi (Ibaraki Univ., Mito (Japan). Dept. of Physics); Gouda, Naoteru; Sugiyama, Naoshi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Mar 1990. 20p. Order Number DE90513791. Source: NTIS (US Sales Only), PC A03/MF A01.

Microwave background anisotropies in various cosmological scenarios are studied. In particular, we examine the extent to which non-scale invariant spectra of the primordial density fluctuations are consistent with the observational upper limits. The resultant constraints are summarized as contours on (n, Ω) plane, where n is the power-law index of the primordial spectrum of density fluctuations, and Ω is the cosmological density parameter. They are compared also with the constraints from the cosmic Mach number test, recently proposed by Ostriker and Suto. The parameter regions which pass both tests are not consistent with the theoretical prejudice inspired by the inflationary model. (author).

45681 (RRK–90-06) **Cosmological N-body simulations with a treecode: Fluctuations in the linear and nonlinear regimes.** Suginohara, Tatsushi (Tokyo Univ. (Japan). Dept. of Physics); Suto, Yasushi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Mar 1990. 34p. Order Number DE90513790. Source: NTIS (US Sales Only), PC A03/MF A01.

Evolution of gravitationally interacting N-body systems in the universe is numerically studied. Our N-body method is based on the hierarchical tree algorithm and the fully periodic boundary condition is implemented by applying the Ewald method. We use 262,144 particles in total, which are initially distributed to represent scale-free power spectra of density fluctuations P(k)proportional to k^n, with n = -2, -1, 0 and 1. The subsequent evolution is followed in both flat and open universes. With this large number of particles, the discretized system can represent the initial linear phase, in good agreement with analytic theory. Dynamics in the strongly nonlinear regime depends on both the spectral index n and the density parameter Ω. In Ω = 1 universes, evolution of two-point correlation functions ξ for ξ > or approx. 100 agrees with the similarity solutions. In the weakly nonlinear regimes, the growth rate of density fluctuations sensitively depends on n. (author).

45682 (RRK–90-07) **Application of the Ewald method to cosmological N-body simulations.** Hernquist, L. (Princeton Univ., NJ (USA). Observatory); Suto, Yasushi; Bouchet, F.R. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Mar 1990. 21p. Order Number DE90513789. Source: NTIS (US Sales Only), PC A03/MF A01.

Fully periodic boundary conditions are incorporated into a gridless cosmological N-body code using the Ewald method. It is shown that the linear evolution of density fluctuations agrees well with analytic calculations, contrary to the case of quasi-periodic boundary conditions where the fundamental mode grows too rapidly. The implementation of fully periodic boundaries is of particular importance to relative comparisons of methods based on hierarchical tree algorithms and more traditional schemes using Fourier techniques such as PM and P^3M codes. (author).

45683 (RRK–90-8) **The role of shear in the cosmological distance.** Watanabe, Kazuya; Sasaki, Misao. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Mar 1990. 10p. Order Number DE90513788. Source: NTIS (US Sales Only), PC A02/MF A01.

The effect of shear along light rays on the distance-redshift relation in an inhomogeneous universe is investigated on the basis of relativistic optical equations. With some reasonable assumptions, an analytic formula for the shear in a simplified cosmological model is derived. We compare the derived formula with numerical calculations and discuss the validity and limitation of our formula. Then the role of shear in the distance-redshift relation is discussed in detail. (author).

45684 (UCRL–102955) **Monte Carlo simulation of complex spectra for opacity calculations.** Klapish, M. (Lawrence Berkeley Lab., CA (USA)); Duffy, P.; Goldstein, W. Lawrence Livermore National Lab., CA (USA). 8 Jun 1990. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006256–1: American astronomical society meeting, Albuquerque, NM (USA), 10-14 Jun 1990). Order Number DE90015198. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Calculating stellar opacities often involves calculating spectra containing millions of lines. Current methods for doing this are not always adequate. Exact calculations of these spectra can take too long to be practical, and the Unresolved Transition Array (UTA) approach, which assumes individual lines are not resolved, often gives very poor results. We are developing a new, Monte-Carlo approach to calculating opacities of complex spectra which is much faster than exact calculations and gives much better results than the UTA approach. The key idea is that to calculate opacities over small wavelength ranges, it is not necessary to know the correct wavelengths or strengths of individual lines. As long as certain statistical properties of the spectrum are correct, calculated opacities will be approximately right. All the atomic physics in our model is of a statistical nature; we do not calculate the real strength or energy of any lines. Specific properties which our Monte Carlo Spectra reproduce are the total strength of all lines, their mean wavelength,

and their wavelength "spread," as well as the statistical distribution of line strengths. We do this separately for each transition array in the spectrum. In several test cases where exact calculations are possible, our model gives Rosseland mean opacities from about three times less than to the same as the exact result. By comparison, the UTA approach gives results orders of magnitude too large. In these cases our results vary by about 10% from run to run due to statistical fluctuations; in cases of real interest, which involve more lines, these variations should be smaller.

45685 (UCRL-CR–103554) **Hard x-ray imaging telescope: Final report, February 1, 1989–September 30, 1989.** Lubin, P. (California Univ., Santa Barbara, CA (USA). Dept. of Physics). Lawrence Livermore National Lab., CA (USA). 1 Mar 1990. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015815. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This final report covers the work carried out under the LLNL Contract Number B063682, Subcontractor Regents University of California at Santa Barbara. The research carried out under this contract involves the construction of a telemetry, target acquisition and guidance system, and of a light-weight gondola to house an x-ray spectrometer. This work is part of the design and construction of the balloon experiment, GRATIS, which will perform the first arcminute imaging of cosmic sources in the 30–200 keV energy band. Observations conducted with GRATIS are expected to provide data relevant to several key problems in high energy astrophysics including the physical processes responsible for the high energy tail observed in the soft gamma-ray spectra of clusters of galaxies and the origin of both the diffuse and point source components of the gamma-ray emission from the Galactic Center. This report discusses the scientific motivations for this experiment, presents several aspects of the design and construction of the hardware components, gives an overview of the stabilized platform, and demonstrates the expected performance and sensitivity. 16 refs., 4 figs., 1 tab.

45686 (UCRL-JC–104339) **XMM [X-ray Multi-Mirror Mission] space telescope: Development plan for the lightweight replicated x-ray gratings.** Montesanti, R.C.; Atkinson, D.P.; Edwards, D.F.; Klingmann, J.L. Lawrence Livermore National Lab., CA (USA). Jun 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–27: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015620. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An approach and development plan for the production of replicated variable line spacing x-ray reflection gratings on lightweight substrates is described. The gratings will be arrayed in spectrometers to analyze the soft x-rays gathered by the telescopes flown around the European Space Agency (ESA) "X-ray Multi-Mirror Mission" (XMM). The mission requires about 750 gratings to form 3 arrays. Each array provides a grating area of approximately 5 square meters. From relatively few master gratings, the low blaze angle gratings will be replicated onto 55 gram substrates having an equivalent length/thickness aspect ratio $\geq$40. We will describe the criteria used for selecting the substrate design and material. A multi-phased study to solve identified technical problems associated with the replication of these gratings is also described. We will report on the present status of the substrates and replication process. 3 refs., 5 figs.

45687 (UCRL-JC–104603) **Prospects for nuclear astrophysics with intense radioactive ion beams.** Mathews, G.J. Lawrence Livermore National Lab., CA (USA). Jul 1990. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9004209–6: Workshop on the science of intense radioactive ion beams, Los Alamos, NM (USA), 10-12 Apr 1990). Order Number DE90015616. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An overview is made of the current and future nuclear data needs in nuclear astrophysics. Subjects discussed include: hydrogen burning reactions in various environments; big-bang nucleosynthesis (particularly with baryon-number inhomogeneities); heavy-element nucleosynthesis; and presupernova cores. A wish list is constructed of most desired unknown reaction rates in each of these areas. It is concluded that a facility for producing heavy-ion radioactive nuclear beams may provide a means to determine many of these reaction rates. 86 refs., 9 figs., 4 tabs.

45688 **Neutrino emission from cooling neutron stars.** Myra, E.S, (State Univ. of New York, Stony Brook, NY (USA). Dept. of Earth and Space Sciences); Lattimer, J.M.; Yahil, A. pp. 213-216 of Supernova 1987A in the large Magellanic Cloud. Kafatos, M.; Michalitsianos, A.G. Cambridge University Press, New York, NY (USA) (1988). (CONF-8710512–: 4. George Mason astrophysics fall workshop on supernova 1987A in the large Magellanic cloud, Fairfax, VA (USA), 12-14 Oct 1987).

Most interpretations of the neutrinos collected from SN 1987A assume the emitted spectrum was in a Fermi-Dirac distribution with zero chemical potential. To investigate this assumption, the authors examine the results of numerical simulations. They also examine models with a power-law atmosphere employing multi-group neutrino transport. They find many of the numerical spectra are best fit by thermal distributions having small positive chemical potentials. Fortunately the effect of such corrections is not appreciable enough to require extensive re-interpretation of the SN 1987A neutrino data.

45689 **Neutrino energetics of SN 1987A.** Lattimer, J.M. (State Univ. of New York, Stony Brook, NY (USA). Dept. of Earth and Space Sciences); Yahil, A. pp. 209-212 of Supernova 1987A in the large Magellanic Cloud. Kafatos, M.; Michalitsianos, A.G. Cambridge University Press, New York, NY (USA) (1988). (CONF-8710512–: 4. George Mason astrophysics fall workshop on supernova 1987A in the large Magellanic cloud, Fairfax, VA (USA), 12-14 Oct 1987).

The total energy and average temperature of neutrinos emitted from SN 1987A are estimated from the Kamioka and IMB observations. Special care has been taken to include the detector response function, which the authors find improves the agreement between the two detections. The authors determine the average neutrino temperature is 3–5 MeV and the total energy emitted in $_e$'s to be 3–5 $\times$ 10^{52} ergs. One sigma errors for the temperature and total energy are large, due primarily to counting statistics. The authors also present Monte Carlo simulations which strongly suggest that the gaps which appear in the Kamioka events are due to low number counting statistics rather than to any pulsing or bursting behavior in the source, as has been suggested in the literature.

45690 **Pulsar formation and the fall back mass fraction.** Colgate, S.A. (Los Alamos National Lab., Los Alamos, NM (US)). pp. 341-348 of Supernova 1987A in the large Magellanic Cloud. Kafatos, M.; Michalitsianos, A.G. Cambridge University Press, New York, NY (USA) (1988). (CONF-8710512–: 4. George Mason astrophysics fall workshop on supernova 1987A in the large Magellanic cloud, Fairfax, VA (USA), 12-14 Oct 1987).

The picture of the explosion of 1987A following collapse to a neutron star and neutrino emission is difficult to reconcile with the subsequent behavior of the ejected mass. It is shown that the inner solar mass of ejected matter should progressively fall back onto the neutron star after it collides with the outer 10–15 $M_\odot$ and after an initial phase of explosion driven by a hot bubble for $t \gtrsim 2 \times 10^3$ s. This fall back is augmented due to heating by the radioactive decay of ^{56}Ni. The matter accreted onto the neutron star rapidly cools due to neutrino emission and merges with the neutron star, thus resulting in zero back pressure to the free falling matter. The predicted fall back mass $\gtrsim$ 1 $M_\odot$ is far larger than is consistent with observations. The author discusses how the most likely explanation is that the hot radiation dominated bubble is continuously heated by neutrino emission from continuing accretion. This accretion continues until the presumed pulsar magnetic field exceeds the bubble pressure.

45691 **A broad band x-ray imaging spectrophotometer to observe SN1987A.** Gotthelf, E.V. (Columbia Univ., New York, NY (USA)); Lum, K.S.K.; McMahon, R.M.; Martin, C.; Novick, R.; Shafer, N.; Szentgyorgyi, A.H.; Fenimore, E.E.; Roussel-Dupre, D. pp. 403-407 of Supernova 1987A in the large Magellanic Cloud. Kafatos, M.; Michalitsianos, A.G. Cambridge University Press, New

York, NY (USA) (1988). (CONF-8710512–: 4. George Mason astrophysics fall workshop on supernova 1987A in the large Magellanic cloud, Fairfax, VA (USA), 12-14 Oct 1987).

This paper reports on a broad band x-ray imaging spectrophotometer (BBXRIS), to be flown as a sounding rocket payload in late 1987. It has been built to make high spatial and spectral resolution observations of SN1987A. The focal plane instrument, an imaging gas scintillation proportional counter, offers energy resolution of 8% (FWHM) at 6 keV, and is sensitive to x-rays from 0.1 to 20.0 keV. Soft x-rays (0.1–1.8 keV) are imaged by a nested pair of Wolter Type I grazing incidence mirrors with a resolution of 8 arcmin, a field of view of 2.6°, and an effective area of 70 cm^2 at 0.2 keV. A specially designed collimator is able to resolve SN1987A from LMC X-1 and provide approximately 70 cm^2 of effective area from 0.1–20.0 keV.

45692 Gravitational couplings of the inflaton in extended inflation. Holman, R. (Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213 (USA)); Kolb, E.W.; Wang, Y. *Physical Review Letters (USA),* 65(1): 17-20 (2 Jul 1990). DOE Contract AC02-76ER03066.

We discuss a new extended-inflationary scenario evading the difficulties of the original model. Our model can thermalize the energy in the bubble walls by the necessary epoch, and establish a Robertson-Walker frame in the bubble clusters. The essential new ingredient in our model is the observation that the coupling of inflaton to the Jordan-Brans-Dicke field is expected to be different from that of visible matter.

45693 Self-collimated electromagnetic jets from magnetized accretion disks - The even-symmetry case. Wang, J.C.L. (Chicago Univ., IL (USA)); Sulkanen, M.E.; Lovelace, R.V.E. *Astrophysical Journal (USA),* 355: 38-43 (May 1990).

This paper extends the previous treatment (Lovelace et al., 1987) of the origin of self-collimated EM jets to the case of even field symmetry, where the magnetic flux function Psi(r, z) is an even function of z. A viscous resistive accretion disk is assumed to surround a black hole with a force-free plasma outside of the disk. Inside the disk, the induction equation is solved for Psi(r, z) and the toroidal magnetic field. Outside the disk, previous results are used to study the formation of self-collimated EM jets. In contrast with the odd-symmetry case, for even symmetry the toroidal magnetic field acts to vertically compress the disk; a comparatively large toroidal magnetic field can exist inside the disk; and an appreciable fraction (possibly all) of the available accretion power can go into the jets. 7 refs.

45694 Low-frequency measurements of the CMB spectrum. Kogut, A. (U. C. Berkeley, Berkeley, CA (USA)); Bensadoun, M.; Amici, G.D.; Levin, S.; Limon, M.; Smoot, G.; Sironi, G.; Bersanelli, M.; Bonelli, G. *AIP Conference Proceedings (American Institute of Physics) (USA),* 198(1): 71-74 (15 Jan 1990). (CONF-8906234–: Workshop on astrophysics in Antarctica, Newark, DE (USA), 8-10 Jun 1989).

As part of an extended program to characterize the spectrum of the cosmic microwave background (CMB) at low frequencies, we have performed multiple measurements from a high-altitude site in California. On average, these measurements suggests a CMB temperature slightly lower than measurements at higher frequencies. Atmospheric conditions and the encroachment of civilization are now significant limitations from our present observing site. In November 1989, we will make new measurements from the South Pole Amundsen-Scott Station at frequencies 0.82, 1.5, 2.5, 3.8, 7.5, and 90 GHz. We discuss recent measurements and indicate improvements possible from a polar observing site.

45695 Neutrino Astronomy. Halzen, F. (Department of Physics, University of Wisconsin, Madison, WI 53706 (USA)); Learned, J.; Stanev, T. *AIP Conference Proceedings (American Institute of Physics) (USA),* 198(1): 39-51 (15 Jan 1990). DOE Contract AC02-76ER00881. (CONF-8906234–: Workshop on astrophysics in Antarctica, Newark, DE (USA), 8-10 Jun 1989).

We review the arguments supporting the claim that the observation of PeV ($E \gtrsim 10^{15}$ eV) γ-rays from cosmic sources at the flux-levels recently reported, guarantees the detection of neutrinos by detectors with an effective area of order 1 km^2. We emphasize the unique opportunities of neutrino astronomy as well as its multidisciplinary facets touching astronomy, astrophysics, cosmology, and particle physcis. At present we do not know of any cost-effective method to commission neutrino telescopes with $O(1 km^2)$ effective area. We draw attention to the possibility of instrument Antarctic ice as a deep underground telescope detecting Cherenkov, radio of acoustic radiation from neutrino-induced electromagnetic showers.

45696 ICEMANd: Microwave detection of ultra-high energy neutrinos in ice. Ralston, J.P. (Department of Physcis and Astronomy, University of Kansas, Lawrence, Kansas 66045 (USA)); McKay, D.W. *AIP Conference Proceedings (American Institute of Physics) (USA),* 198(1): 52-60 (15 Jan 1990). DOE Contract FG02-85ER40214. (CONF-8906234–: Workshop on astrophysics in Antarctica, Newark, DE (USA), 8-10 Jun 1989).

A muon from an ultra-high energy neutrino interaction produces an electromagnetic shower of considerable length. Coherent Cerenkov emission at microwave frequencies from the electric charge imbalance developing in such a shower serves as an efficient signal of the event. We discuss detecting upward going UHE neutrinos ($E_\nu \gtrsim 10^{15}$ eV) in the Antarctic ice by detecting this microwave signal with comparatively cheap and simple antennas located on the ice surface. We conclude that a pilot experiment to measure UHE neutrinos from point sources such as Cygnus *X-3* is feasible.

45697 Majorons and supernova cooling. Choi, K. (Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213 (USA)); Santamaria, A. *Physical Review, D (Particles Fields) (USA),* 42(2): 293-306 (15 Jul 1990). DOE Contract AC02-76ER03066.

We consider the role of Majoron emission in supernova cooling and its implications for the neutrino mass and lifetime in generic singlet Majoron models. It is found that, for ν_τ with mass m, if the lifetime for the decay $\nu_\tau \to$Majoron+$\nu_{e,\mu}$ is shorter than 10^{-7} (m/MeV) sec, then Majorons are so strongly trapped by the inverse process that the resulting Majoron luminosity is small enough *not* to destabilize the observed ν_e pulse from SN 1987A. For ν_τ with a longer lifetime, the Majoron luminosity can be large enough to destroy or significantly shorten the duration of the neutrino pulse. We then find the range of parameters, e.g., the ν_τ mass m and the $(B-L)$-breaking scale v, that is excluded by giving such a large Majoron luminosity. Our results imply that, for v between 1 GeV and 1 TeV, a wide range of m allowed by terrestrial experiments can be excluded in view of the observed ν_e pulse from SN 1987A.

45698 A study of extreme-ultraviolet emission from cataclysmic variables. Polidan, R.S. (NASA, Goddard Space Flight Center, Greenbelt, MD (USA)); Mauche, C.W.; Wade, R.A. *Astrophysical Journal (USA),* 356: 211-222 (Jun 1990).

Voyager far- and extreme UV spectrophotometric observations of five cataclysmic variables (the dwarf novae SS Cyg and VW Hyi and the novalike variables V3885 Sgr, RW Sex, and IX Vel) are combined with neutral hydrogen column densities derived from the curve-of-growth analysis of interstellar absorption lines in high-resolution IUE spectra to place upper limits on the emitted flux in the 600-700 A EUV band. The Voyager observations of VW Hyi were obtained during both normal and superoutbursts. Detailed accretion disk model calculations show that most of the 600-700 A flux in these systems should originate in the inner accretion disk rather than in the boundary layer. For VW Hyi, the low neutral hydrogen column and excellent Voyager superoutburst data place the observed upper limit to the 600-700 A flux well below the expected EUV flux from the model calculations. 43 refs.

45699 The nu-process. Woosley, S.E. (Lick Observatory, Santa Cruz, CA (USA)); Hartmann, D.H.; Hoffman, R.D.; Haxton, W.C. *Astrophysical Journal (USA),* 356: 272-301 (Jun 1990).

As the core of a massive star collapses to form a neutron star, the flux of neutrinos in the overlying shells of heavy elements becomes so great that, despite the small cross section, substantial nuclear transmutation is induced. Neutrinos excite heavy elements and even helium to particle unbound levels. The evaporation of a single neutron or proton, and the back reaction of these nucleons

on other species present, significantly alters the outcome of traditional nucleosynthesis calculations leading to a new process: nu-nucleosynthesis. Modifications to traditional hydrostatic and explosive varieties of helium, carbon, neon, oxygen, and silicon burning are considered. The results show that a large number of rare isotopes, including many of the odd-Z nuclei from boron through copper, owe much of their present abundance in nature to this process. 112 refs.

45700 **Baryogenesis in a baryon-symmetric universe.** Dodelson, S. (Gordon McKay Laboratory, Harvard University Cambridge, Massachusetts 02138 (USA)); Widrow, L.M. *Physical Review, D (Particles Fields) (USA),* 42(2): 326-342 (15 Jul 1990). DOE Contract FG02-84ER40158.

Baryon number is conserved in all interactions probed by present-day experiments. If baryon number is strictly conserved then currently popular scenarios for baryogenesis will have to be reexamined. We discuss a new paradigm for baryogenesis in which the fundamental Lagrangian is baryon conserving [invariant under $U(1)_B$]. At high temperatures, $U(1)_B$ is spontaneously broken and an excess of quarks over antiquarks of $10^{-10}s$(s==entropy density) is produced. Today, $U(1)_B$ is restored. The most striking consequence of our assumptions is that the baryon number of the Universe is constant. During spontaneous symmetry breaking, the excess of baryons over antibaryons in the quark fields is exactly compensated by antibaryons hidden in the vacuum. Today, antibaryons appear either as massive $U(1)_B$ charged scalar particles or as stable, nontopological bubbles of antimatter. One intriguing possibility suggested by our scenario is that the dark matter may be antimatter.

45701 **Dynamics of domain walls and strings.** Gregory, R. (NS/Fermilab Astrophysics Center, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL (USA)); Haws, D.; Garfinkle, D. *Physical Review, D (Particles Fields) (USA),* 42(2): 343-348 (15 Jul 1990).

The leading-order finite-width corrections to the equation of motion describing the motion of a domain wall are derived. The regime in which this equation of motion is invalid is discussed. Spherically and cylindrically symmetric solutions to this equation of motion are found. We also clarify a misconception that has arisen in recent years regarding the rigidity (or otherwise) of cosmic strings.

45702 **Shear-free spherically symmetric inhomogeneous cosmological model with heat flow and bulk viscosity.** Deng, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06269 (USA)); Mannheim, P.D. *Physical Review, D (Particles Fields) (USA),* 42(2): 371-383 (15 Jul 1990). DOE Contract AC02-79ER10336.

An exact solution to the Einstein equations with a shear-free imperfect-fluid source is obtained. The solution approaches a locally flat Robertson-Walker one in the large-t limit and thus serves as a viable candidate for a realistic cosmological model. The model built out of this solution is found to be free of horizon, entropy, and flatness problems.

45703 **Spherically symmetric near-critical accretion onto neutron stars.** Miller, G.S. (Illinois Univ., Urbana (USA)). *Astrophysical Journal (USA),* 356: 572-579 (Jun 1990).

Numerical and approximate analytic solutions for time-independent, spherically symmetric, radiation pressure-dominated accretion flows are presented. For flows with luminosities at infinity, L-infinity, sufficiently close to the Eddington limit L-crit, the flow velocity profile is qualitatively different from the modified free-fall profile v(r) = (1 - L-infinity/L-crit)exp 1/2 (2GM/r)exp 1/2. Advective contributions to the comoving radiation flux decelerate the flow within a criical radius, and, in this settling region, the velocity of the flow decreases linearly with decreasing radius. 14 refs.

45704 **A variation of the cross-correlation technique.** Furenlid, I. (Georgia State Univ., Atlanta (USA)); Furenlid, L. *Publications of the Astronomical Society of the Pacific (USA),* 102: 592-597 (May 1990).

A simplified, but versatile, cross-correlation technique is described. Suitable applications are determinations of radial velocities and searches for binary-star secondaries as well as interpretations of complicated spectra. The small number of operations used in defining the cross-correlation function allows the technique to be implemented in an on-line mode. 14 refs.

6402 Atmospheric Physics

Refer also to citation(s) 45253, 45254, 45255, 45256, 45676, 45738

45705 (AD-A–221059/9/XAB) **Models of the external-source contribution to magnetospheric magnetic fields for CRRES data analysis. Report for June 1989-January 1990.** Bass, J.N.; Jordan, C.E. Radex, Inc., Bedford, MA (USA). 31 Jan 1990. 47p. (RX-R–90011). Source: NTIS, PC A03/MF A01.

The Olson-Pfitzer tilt dependent, the Mead-Fairfield, the Tsyganenko-Usmanov, the Tsyganenko 1987, the Olson-Pfitzer dynamic, and the Stern external magnetic field models are reviewed for their appropriateness for use in analysis of data from the Combined Release and Radiation Effects Satellite (CRRES). Descriptions of the models and their derivations are given. The Stern model requires considerably more computation time than the others. The L-parameter computed with an internal plus external field deviates considerably from that obtained with the internal field alone at the larger radial distances in CRRES's range. The models also differ noticeably from one another. The magnetic field magnitudes computed from the models during a SCATHA orbit over a magnetically quiet period agree well with SCATHA magnetometer observations. The Olson-Pfitzer dynamic model best tracks the data. However during the subsequent orbit, none of the models depict the large observed substorm- associated depression. The equatorial midnight field depression predicted by the Olson-Pfitzer dynamic model at zero dipole tilt is larger at small distances than that implied by averaged AMPTE and OGO measurements; the Stern and Olson-Pfitzer tilt dependent models are in good agreement with the measurements, while the other models predict smaller depressions. It is concluded that the Olson-Pfitzer dynamic model is the best to use for CRRES, primarily because of its parameterization and its superior data base in the CRRES range.

45706 (AD-A–221068/0/XAB) **Current status of SHARC, the Strategic High-Altitude Radiance Code, and description of its new auroral module.** Sharma, R.; Ratkowski, A.; Duff, J.; Bernstein, L.; Gruninger, J. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 20 Apr 1990. 14p. (GL-TR–90-0097). Source: NTIS, PC A03/MF A01.

The Strategic High-Altitude Radiance Code (SHARC) is a new computer code that calculates atmospheric radiation in the mesosphere and thermosphere. The initial version, SHARC-1, is available for distribution. This talk discusses the capabilities of this code and describes the new auroral model which will be incorporated in the next version. SHARC calculates radiance and transmittance for paths from 60 to 300 km altitude in the 2-40 microns spectral region. It models radiation due to NLTE (Non-Local Thermodynamic Equilibrium) molecular emissions which are the dominant sources at these altitudes.

45707 (AD-A–221330/4/XAB) **Plasma-wave observations during ion-gun experiments. Technical report.** Olsen, R.C.; Weddle, L.E.; Roeder, J.L. Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab. 20 Mar 1990. 47p. (TR–0089(4940-06)-6). Source: NTIS, PC A03/MF A01.

Experiments in charge control on the P78-2 (SCATHA) satellite were conducted with a plasma/ion source in the inner magnetosphere. These experiments were monitored with plasma wave instruments capable of high temporal and frequency resolution in the 0 to 6 kHz frequency range. Ion gun experiments revealed two distinct classes of behavior. Nonneutralized ion beam operation at 1 mA, 1 kV resulted in arcing signatures (spiky in time, broad frequency range), coincident with induced satellite potentials of -600 to -900 V. This signature disappeared when the accelerating voltage was switched off or the beam was neutralized (at which time the satellite body approached potentials of a few volts). The signal is attributed to arcing between differentially charged surfaces. An additional feature was noted in the 100 kHz channel of the wave receiver. During emission of dense, low energy plasma, a signal is

generated which may be at the upper hybrid, or plasma, frequency for the local plasma.

45708 (AD-A-221577/0/XAB) **EINMUF: An h-f MUF, FOT, LUF prediction program. Final report, March-December 1989.** Daehler, M. Naval Research Lab., Washington, DC (USA). 18 May 1990. 51p. (NRL-MR-6645). Source: NTIS, PC A04/MF A01.

This work describes a FORTRAN algorithm, called Subroutine EINMUF, which predicts the Maximum Usable Frequency (MUF), the Frequency of Optimum Transmission (FOT), and the Lowest Usable Frequency (LUF) on a specified HF communications path. A single call to EINMUF produces up to 24 predictions at hourly intervals starting with a specified day-time group DTG. MOF calculations are made with the NOSC MINIMUF85 MUF-prediction program using the first available sunspot number SSN from the following list: (a) an effective SSN derived from current oblique-incidence sounder data; (b) a 5-day running average of SSNs derived from solar 10.7 cm flux measurements or direct SSN measurements; (c) an effective SSN determined from old sounder data; (d) SSN extrapolated from previous SSN measurements by the McNish-Lincoln method; (e) SSN derived from a mean-value representation of the 11-year solar sunspot number cycle.

45709 (AD-A-221719/8/XAB) **Coordinated satellite and ground-based measurements of the energy characteristics of a sun-aligned arc over Soendre Stroemfjord.** Niciejewski, R.J.; Meriwether, J.W.; McCormac, F.G.; Hecht, J.H.; Christensen, A.B. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1 Dec 1989. 15p. (GL-TR-90-0105). Source: NTIS, PC A03/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 94, No. A12, 17, 201-217, 213(1 Dec 1989).

A CEDAR campaign organized to observe Sun-aligned arcs from Soendre Stroemfjord, Greenland, obtained a coordinated satellite- and ground-based observation of the development and subsequent zenithal passage of a Sun-aligned transpolar arc on February 26, 1987. A broad array of ground-based optical instruments plus the Soendre Stroemfjord incoherent scatter radar characterized the optical and ionospheric parameters of the arc as it passed through the geomagnetic zenith. Optical instrumentation obtained detailed intensity measurements in the geomagnetic zenith for several auroral emissions and recorded the spatial and temporal evolution of the arc. During the transit of the arc the incoherent scatter radar was pointed in the geomagnetic zenith direction, providing electron density height profiles. the DMSP F6 satellite imaged a segment of the Sun-aligned arc and measured the precipitating flux along its path at the same time that ground-based measurements were being taken. All-sky images in N2(+) 1 NG and O I(6300 A) emissions reveal the progression of the arc from an F region feature to an E region feature and its resulting stability for the following 20 min as it drifted out of the zenith. Our results show that this event is best described by a soft electron precipitation with a very low upper limit imposed on the proton contribution.

45710 (AD-A-221801/4/XAB) **Radiation-belt dynamics during solar minimum. Technical report.** Gussenhoven, M.S.; Mullen, E.G.; Holeman, E. Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD (USA). Dec 1989. 9p. (GL-TR-90-0125). Source: NTIS, PC A02/MF A01.

Pub. in IEEE Transactions on Nuclear Science, Vol. 36, No. 6, 2008-2014(Dec 1989).

Two types of temporal variation in the radiation belts are studied using low altitude data taken onboard the DMSP F7 satellite: those associated with the solar cycle and those associated with large magnetic storm effects. Over a three-year period from 1984 to 1987 and encompassing solar minimum, the protons in the heart of the inner belt increased at a rate of approximately 6% per year. Over the same period, outer zone electron enhancements declined both in number and peak intensity. During the large magnetic storm of February 1986, following the period of peak ring current intensity, a second proton belt with energies up to 50 MeV was found at magnetic latitudes between 45 deg. and 55 deg. The belt lasted for more than 100 days. The slot region between the inner and outer electron belts collapsed by the merging of the two populations and did not reform for 40 days.

45711 (AD-A-221816/2/XAB) **Evaluation of magnetospheric internal-magnetic-field models and existing software. Report No. 3, June 1989-January 1990.** Jordon, C.E.; Bass, J.N. Radex, Inc., Bedford, MA (USA). 31 Jan 1990. 80p. (RX-R-90012). Source: NTIS, PC A05/MF A01.

In preparation for analysis of the CRRES databases (to be taken from 1990 to 1995) and, in particular, for an updated static radiation belt model, a comparison has been made of four magnetospheric internal magnetic field models. Since there is interest in radiation belt models out to geosynchronous altitudes, it will be necessary to consider the external magnetic field models as well, but for now just the internal models will be discussed. The four models reviewed here are Barraclough, MAGSAT, IGRF 1985, and Cain. Each of these has an optimal time period associated with it: Barraclough 1975, MAGSAT 1980, IGRF 1985, and Cain 1990. In the subsequent sections of this report, the derviations of these models will be summarized. They are all based on these spherical harmonic expansion of the magnetic field's scalar potential. The data used to determine each set of coefficients will be briefly discussed. Then the models will be evaluated by comparing the magnetic field and L-shell values obtained from each of the models. Finally, various computer codes which use these models to evaluate the field and L-shell, will be compared and evaluated in terms of their performance (i.e. accuracy and speed). A primary concern for radiation belt models is reduction of the number of binning parameters by using B-L coordinates.

45712 (DOE/ER/13530-T1) **A study of magnetic field reconnection and plasma processes in the magnetosphere: Summary progress report.** Lee, L.C.; Akasofu, S.I. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. Jul 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER13530. Order Number DE90016117. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The basic plasma processes associated with magnetic reconnection in the earth's magnetosphere are studied in our proposed project. In the past year, several problems associated with the 2-D and 3-D nonlinear reconnection processes were investigated. The theoretical and simulation results from present magnetosphere study are also applicable to plasma research in the other fields such as thermonuclear fusion solar physics, and astrophysics. In the past year, we have made important progresses on several research areas. A brief description of our research progresses is presented and a list of our publications published in the year of 1989-1990 is also included.

45713 (EGG-10617-5048) **[Crossed-microwave-beam air ionization lab].** Armstrong, W.T. (Los Alamos National Lab., NM (USA)); Karl, R.; Kelly, M.; Roussel-Dupre, R.; Buchwald, M.; Sutherland, C.D.; Zinn, J.; Alvarez, R.; Bolton, P.; Sieger, G.; Patterson, W.; Hunton, D.; Trzcinski, E.; Eckstrom, D.; Stalder, K.; Testerman, L.;EG and G Energy Measurements, Inc., Las Vegas, NV (USA). [1990]. 15p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. Order Number DE90012579. Source: NTIS, PC A03/MF A01 - OSTI.

High power microwave radiation is under consideration for use as an ionizing agent to form a radio reflecting region in the stratospheric/mesospheric altitude range. The ionization region is referred to as an Artificial Ionization Layer (AIL) or Artificial Ionization Mirror (AIM). An AIL could conceivably avoid constraints of reflection from the ionosphere: (1) limitation to ~30 MHz reflection frequencies, (2) erratic variations due to it's natural origin, and (3) reduction of a blind "skip" area for high frequency reflections. Work in the United States in this area began with the introduction of the concept in the Air Force Forecast II review of new technologies during 1986. Soviet work began earlier in the 1970's and continued into the 1980's with a benchmark paper by Gurevich appearing in 1980. The experiment goals of AIM-II were to (1) measure ionization thresholds for single and multiple layer formation, (2) characterize the geometry of layer formation, and (3) determine density and effective collision rates in the ionization layer. The AIM-II research campaign, which was performed in the same experimental geometry, was dedicated to repetitive pulse operation to explore the issues surrounding prolonged or "sustained" AIL production that would be

necessary in many application scenarios. The primary issues to be examined included: (1) reproducibility of breakdown geometry, (2) utility of increased ionization background from previous pulses in reducing the power threshold for breakdown by subsequent pulses, and (3) ionization persistence or decay.

45714 **Nonequilibrium nature of ion distribution functions in the high latitude auroral ionosphere.** Shizgal, B.; Hubert, D. pp. 3-22 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The velocity distribution function of ions under the influence of the geomagnetic field and crossed ionospheric electric field is calculated from the Boltzmann equation for the r exp -4 ion-neutral (polarization) interaction. The distribution function departs significantly from Maxwellian for large electric fields and small ion-neutral collision rates. An important parameter that determines the extent of the departure from equilibrium is the ratio nu/Omega, where nu is the ion-neutral collision rate and Omega is the ion gyration frequency. The distribution function is determined by its expansion in the Burnett functions, which are eigenfunctions of the collision operator for the polarization interaction. A recursion relation valid for all nu/Omega is derived for the velocity moments of the Burnett functions. The ion velocity distribution function is then determined in terms of these velocity moments. 25 refs.

45715 **Laboratory simulations of energetic atom interactions occurring in low earth orbit.** Caledonia, G.E. (Southern California Univ., Los Angeles, CA (USA)). pp. 129-142 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The Space Shuttle flights provided the first significant data base on the environment experienced by a large space structure operating in LEO. A number of interesting and unanticipated effects were observed, including material erosion induced by ambient oxygen atoms, the visible Shuttle glow occurring above surfaces exposed to the ram flow, and large near-field perturbations and variability in the gaseous neutral and plasma environment about the Shuttle. This paper provides a brief overview of these observations and their phenomenological interpretation, and then discusses laboratory approaches to their investigation. The emphasis is on the state of the art in the development of energetic oxygen atoms sources and the variety of experiments presently being performed with such devices. 17 refs.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 44063, 44727, 44850, 44862, 44872, 44881, 44892, 44897, 44949, 44950, 44953, 44959, 44976, 44986, 45057, 45064, 45065, 45066, 45067, 45086, 45466, 45684, 45911, 45913, 45914, 45916, 45918, 45920, 45921, 45922, 45923, 45925, 45926, 45927, 45928, 45932, 45977, 46069, 46071, 46072, 46121, 46165, 46168, 46173, 46178, 46225

45716 (AD-A–221331/2/XAB) **Traps for neutral atoms. Annual report, 1 September 1988-31 August 1989.** Pritchard, D. Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics. 31 Aug 1989. 7p. Source: NTIS, PC A02/MF A01.

We have trapped large numbers of neutral atoms, and cooled them to millikelvin temperatures. Our next objective is to cool them to microkelvin temperatures. Dense samples of atoms cooled to microkelvin temperatures promise to open up new and exciting areas of physics. The lack of interaction of the low velocity atoms due to their reduced thermal motion, together with the possibility of indefinitely long interaction times, make samples of trapped atoms ideal for high resolution spectroscopy and for use as atomic frequency standards. Our main current effort in neutral atom trapping is cooling of trapped atoms to low temperatures. While this remains a difficult and elusive goal (to date, micro-kelvin temperatures have only been achieved with untrapped atoms), the rewards for supercooling trapped atoms appear to be high. The long confinement times, together with the reduced thermal motion of cold atoms, could result in a new era of ultra-high resolution spectroscopy and precise frequency standards. Potentially more exciting is the possibility of combining the high densities achievable in traps and the long deBroglie wavelength of ultra-cold atoms to observe novel quantum collective phenomena.

45717 (CEA-CONF–10027) **Collective flow measurements in asymmetric nuclear collisions.** Gosset, J. (and others); L'hote, D.; Valette, O.; Babinet, R.; Cavata, C.; Marco, N. de; Fanet, H.; Fodor, Z.; Lemaire, M.C.; Lucas, B.; Alard, J.P.; Augerat, J.; Bastid, N.; Charmensat, P.; Dupieux, P.; Fraysse, L.; Marroncle, J.; Montarou, G.; Par. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire. 1989. 10p. (CONF-8905143–: NATO advanced study institute international advanced course on the nuclear equation of state, Peniscola (Spain), 12 May - 3 jun 1989). Order Number DE90514651. Source: NTIS (US Sales Only), PC A02/MF A01.

The collective flow measurements presented in this lecture have been performed with the DIOGENE electronic 4π-detector installed at the Saturne synchrotron in Saclay, which can deliver beams up to mass 40. In order to study the properties of dense (and hot) nuclear matter, it is required to measure nucleus-nucleus collisions involving a large number of nucleons. That is the reason why we focused our experiment on asymmetric collisions, with target nuclei heavier than the beam. We measured triple differential cross sections of pseudoprotons (free protons as well as protons bound in light nuclei), inside the acceptance of the DIOGENE pictorial drift chamber (PDC), restricted to $20^0 < \theta < 132^0$ in polar angle and to kinetic energy larger than $\approx$ 40 MeV. We analysed these cross sections in three different ways, which lead to various features of the collective flow: the usual flow parameter F, azimuthal angular distributions $dN/d\Phi$ showing possible evidence for preferential emission transversely to the reaction plane, and finally two-dimensional Gaussian fits giving a more complete characterization of the participants collective flow, with the flow angle and two aspect ratios.

45718 (FRCEA-TH–286) **Study of the reaction mechanisms leading to projectile fragmentation in ^{40} Ar + Ag nat reactions at 30 MeV and 60 MeV per nucleon.** Gadi-Dayras, F.Z. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Basse Energie; Paris-11 Univ., 91 - Orsay (France). 1988. 189p. (In French). Order Number DE90514697. Source: NTIS (US Sales Only), PC A09/MF A01.

This work is devoted to a study of the reaction mechanisms leading to projectile fragmentation in heavy ion collisions at intermediate energy (less than 100 MeV per nucleon). In contradiction with some theoretical calculations, inclusive measurements of projectile fragments as well as correlation measurements between projectile and target fragments in the reaction $^{40}Ar + {}^{nat}Ag$ at 30 MeV and 60 MeV per nucleon do not show any evidence for a change in the reaction mechanism in this energy range. Angular, mass and velocity correlations between projectile and target fragments enable us to reject mass transfer from projectile to target as a leading mechanism in projectile fragmentations. However, a coherent description of the data can be given either in the framework of an abrasion-ablation model in which the primary fragments of the projectile and of the target are produced with very low excitation energies, or assuming a two-body reaction, reminiscent of the first steps of deeply inelastic collisions, in which the dissipated energy is shared about equally between strongly excited projectile and target. The high excitation energies deduced from the two-body analysis bring in question our description of the fragmentation process. Thus, the excitation energy of the primary fragment is a key parameter which may be used in future experiments to distinguish between different reaction mechanisms.

45719 (KEK–89-19, pp. 83-87) **High energy magnetic excitations from quantum spin magnets: A proposed subject for Japan - UK collaboration project.** Endoh, Yasuo (Tohoku Univ., Sendai (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1989. (CONF-8911202–: 2.

workshop of Japan-UK collaboration on neutron scattering research, Tsukuba (Japan), 1 Nov 1989). In *Proceedings of the second workshop of Japan-UK collaboration on neutron scattering research.* Order Number DE90798861. Source: NTIS (US Sales Only), PC A07/MF A01.

Published in summary form only. MAGNETS/excitation; MAGNETS/spin orientation; OXIDES; LANTHANUM IONS; COPPER IONS; ANTIFERROMAGNETISM; MAGNETS; EXCITATION; ENERGY DEPENDENCE; HEISENBERG MODEL; QUANTUM MECHANICS

45720 (LYCEN–89-02) **Biennial studies of nuclear physic.** Bedjidian, M. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. 392p. (In FR, EN). (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

This 10th biennial studies session of nuclear physic make a survey of the recent experimental developments as well as the evolution of the theoretical ideas in Nuclear Physics.

45721 (LYCEN–89-02 C.1.1-C.1.17) **The J/ψ production in ultra-relativistic heavy ions collisions Results from the NA38 experiment.** Baglin, C. (Grenoble-1 Univ., 74 - Annecy (FR). Lab. de Physique des Particules Elementaires); Bussiere, A.; Guillaud, J.P.; Staley, F.; Ogren, H.; Sonderegger, P.; Baldit, A.; Castor, J.; Devaux, A.; Fargeix, J.; Felgeyrolles, X.; Force, P. NA38 Collaboration. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Muon pairs production together with the correlated transverse energy have been measured with 200 Gev/N incident particles (p, O^{16}, S^{32}) bombarding Uranium or Copper targets. With increasing transverse energy a strong J/ψ suppression, relatively to the continuum, has been observed with incident ions. Also, this effect is enhanced at low transverse momentum. These results have been predicted to occur in case of quarks and gluons plasma formation.

45722 (LYCEN–89-02 C.12.1-C.12.11) **Spin-isospin collective modes Δ in nuclei.** Roy-Stephan, M. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The charge-exchange reactions display the response of nuclei to a spin-isospin excitation. This response is concentrated in two excitation energy domains: - At low excitation energy, several particle-hole states contribute, the Gamow-Teller resonance and higher multipolarity spin-flip resonances. - Around 300 MeV, a nucleon from the target is excited into a Δ 1232 resonance. The strength in the Δ sector has the same order of magnitude as in the nuclear sector. The peak corresponding to Δ excitation in nuclei is energy shifted from the peak of the free Δ created in the reaction on hydrogen.

45723 (LYCEN–89-02 C.14.1-C.14.11) **Coincidence experiments with high duty cycle electron accelerators in the near future.** Schoch, B.H. (Mainz, Univ., (DE). Inst. fuer Kernphysik). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

In nuclear physics the limits of the traditional framework in which nonrelativistic nucleons interact through potentials have become apparent. The role of the underlying quark substructure of the nucleons in determining the properties of nuclear forces and the structure of atomic nuclei has to be uncovered. Experiments using the new electron facilities will provide important insights for advancing nuclear physics along these new directions.

45724 (LYCEN–89-02 C.2.1-C.2.15) **The nuclear response functions with polarized particles.** Bonin, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Moyenne Energie). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

We present here a review of the problems brought up by the spin response functions in nuclei. The experimental tools involved in this study are discussed, with special emphasis on polarized hadronic probes.

45725 (LYCEN–89-02 C.4.1-C.4.26) **Delta excitation in nuclei: the lesson of charge exchange reactions.** Delorme, J. (Lyon-1 Univ., 69 - Villeurbanne (FR). Inst. de Physique Nucleaire); Guichon, P.A.M. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

We present an attempt of theoretical interpretation of charge exchange reactions on nuclei in the region of the delta resonance. Special care is taken to insure consistency with the constraints from pion and photon excitation channels. Good agreement with measured spectra can be obtained for all types of targets and incident ions except for polarized deuterons data which appear hardly reconcilable with the others within our interpretation. Despite the peripheral character of these reactions, a sizeable part of the observed downward shift of the resonance is possibly ascribable to a yet undetected collective mode of the nucleus at high excitation, the pionic branch. Our limited commitment is due to uncomplete knowledge of the NN→NΔ interaction and the transition form factors of the probing ions which has been palliated by some phenomenology.

45726 (LYCEN–89-02 C.8.1-C.8.10) **Polarization measurements in elastic electron-deuteron scattering.** Garcon, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Moyenne Energie). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

After some recalls on the electromagnetic form factors of the deuteron, we describe an experience made in the MIT Bates Linac having for objective the measure of the tensorial polarization of recoil deuteron in the elastic scattering of electron-deuteron until $q=4.6\ fm^{-1}$. We compare some experimental methods for the determination of this observable.

45727 (LYCEN–89-02 S.1.1-S.1.18) **Polarization observables in elementary K^+-Photoproduction.** Adelseck, R.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Haute Energie); Saghai, B. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The theoretical and experimental status of positive kaon photoproduction off protons from threshold up to 1.4 GeV is briefly reviewed. A model based on Feynman diagrams including several hadronic resonance exchanges is presented. The results of this model are compared with the differential cross section and the Λ -polarization asymmetry data. Predictions on other polarization observables are reported and the need for further measurements is emphasized.

45728 (LYCEN–89-02 S.7.1-S.7.13) **Constituent approach to high energy elastic scattering of hadrons.** Furget, C. (Grenoble-1 Univ., 38 (FR). Inst. des Sciences Nucleaires); Buenerd, M. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on

nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The work reported here describes a phenomenological approach to the hyperon-nucleon cross-section. This latter work has been undertaken in the context of the experiment WA89 at CERN which will offer the unique opportunity of measuring these cross-sections over the center of mass energy domain $\sqrt{s} \simeq 20 \pm 5$ GeV.

45729 (LYCEN–89-02 S.9.1-S.9.9) **Review of recent measurements on neutral pion photoproduction near threshold experimental features.** Martin, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Haute Energie). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The experimental situation of neutral pion photoproduction has been definitely improved by recent absolute measurements of fundamental quantities of the low energy pion nucleon interaction. The data obtained at Saclay, on the proton and several nuclei (^{4}He, ^{12}C, ^{40}Ca and a few results on ^{6}Li and Mg) using the A.L.S. tagged monochromatic photon beam, from reaction threshold energy up to 180 MeV, are confirmed by very recent measurements performed at Mainz with the 100% duty cycle electrons accelerator MAMI A. A large disagreement between these results and theoretical predictions appears. This coherent set of datas now give very strong constraints for further models.

45730 (MLM–3635) **Additions and revisions to the algorithms and Fortran programs to calculate quantum collision integrals for realistic intermolecular potentials.** Hurly, J.J. (Cincinnati Univ., OH (USA). Dept. of Chemistry); McConville, G.T.; Taylor, W.L. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 24 Aug 1990. 77p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-88DP43495. Order Number DE90014885. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report is an addendum to MLM-3321, Algorithms and Fortran Programs to Calculate Quantum Collision Integrals for Realistic Intermolecular Potentials, by William L. Taylor. The programs presented in MLM-3321 were written for the Mod-Comp computer that is now essentially obsolete; in this report, those programs have been revised for the IBM 3090, a much faster and larger machine. Several procedures were used by Taylor to minimize program run times, and most of the calculation was limited to single precision. When using the IBM 3090, the importance of time saving and conservation of storage locations is far less and this has allowed improvements to be made in the accuracy of the calculations.

45731 (ORNL/FTR–2635) **[Eighteenth International conference on phenomena in ionized gases]: Foreign trip report, July 11, 1987–August 2, 1987.** Hunter, S.R. Oak Ridge National Lab., TN (USA). 14 Aug 1987. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016115. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the XVIII International Conference on Phenomena in Ionized Gases and presented a paper "Electron Transport Studies of Gaseous Media for Diffuse Discharge Closing Switches." This is a large conference attended mainly by eastern and western European participants and covers many branches of gas discharge physics, including basic and applied studies. The traveler also presented a paper entitled "Low Energy Electron Drift and Scattering in Krypton and Xenon" at the 5th International Swarm Seminar. The emphasis of this conference was on basic electron and ion-molecule interaction processes which are of considerable interest in our more applied gas discharge programs. During the seminar the traveler also visited the experimental laboratories of Professor D. Smith and Dr. N. G. Adams at the Department of Space Research, University of Birmingham, UK, and discussed their experimental techniques and electron attachment measurements which, in some gases, are in considerable disagreement with those obtained by the traveler's group at ORNL.

45732 (SAND–90-1442C) **Time-dependent behavior of positrons in noble gases.** Wadehra, J.M. (Wayne State Univ., Detroit, MI (USA). Dept. of Physics and Astronomy); Drallos, P.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 13p. Sponsored by U.S. Department of Defense. Grant: AFOSR-87-0342. (CONF-9007139–2: 3. international workshop on positron and positronium chemistry, Milwaukee, WI (USA), 16-19 Jul 1990). Order Number DE90015699. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Both equilibrium and nonequilibrium behaviors of positrons in several noble gases are reviewed. Our novel procedure for obtaining the time-dependent behavior of various swarm parameters – such as the positron drift velocity, average positron energy, positron annihilation rate (or equivalently Z_{eff}) etc. – for positrons in pure ambient gases subjected to external electrostatic fields is described. Summaries of time-dependent as well as electric field-dependent results for positron swarms in various noble gases are presented. New time-dependent results for positron swarms in neon are also described in detail. 36 refs., 4 figs., 3 tabs.

45733 (UCRL-ID–103344) **Theoretical studies of High Energy Density Matter (HEDM) molecules: Final report FY89.** Lengsfield, B.H. III. Lawrence Livermore National Lab., CA (USA). Mar 1990. 29p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90014831. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This research effort consisted of two task. The first task was to improve and document the MESA series of electronic structure codes. The second task was to carry out theoretical studies of the molecules B_2H_2 and Be_2H_2 in order to assess their potential as high energy density materials. This report is organized as follows, a summary is given of the progress attained on each of the tasks. In these sections, the arguments used to motivate support for this work will be repeated so that the results attained in this study can measured against the goals put forth in the funding proposal. Then, a detailed description of the B_2H_2 and Be_2H_2 calculations is provided. A concluding section follows which concisely reviews the progress attained to date and suggests areas which merit further study. Finally, the MESA documentation is included as an appendix to this report. 16 refs., 8 figs., 12 tabs.

45734 (UCRL-JC–104238) **Nonequilibrium molecular dynamics: Past, present, and future.** Hoover, W.G. (Keio Univ., Tokyo (Japan)). Lawrence Livermore National Lab., CA (USA). Apr 1990. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9003186–1: 45. annual meeting of the physics society of Japan, Osaka (Japan), 30 Mar - 2 apr 1990). Order Number DE90015366. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the past, present and future of calculation methods in nonequilibrium molecular dynamics. (LSP)

45735 (UM-P–89/37) **Stark effect for a rigid symmetric top molecule: exact solution.** Hajnal, J.V.; Opat, G.I. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 15p. Order Number DE90635730. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

An exact expression is presented for the energy levels of a rigid symmetric top molecule in an external electric field of arbitrary strength. The solution of this Stark splitting problem is presented in the form of a rapidly convergent continued fraction, well-suited to numerical evaluation for any state. 5 refs., 3 figs.

45736 **Semiclassical approach to atomic and molecular interactions.** Kunc, J.A. (Southern California Univ., Los Angeles, CA (USA)). pp. 55-75 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

A general approach, combining quantum and classical mechanics, is used to determine the electron position and velocity distributions in atoms and atomic ions (positive and negative). The Hartree-Fock electronic wave functions and the classical central field approximation are used for evaluation of the dynamic properties of the localized electrons. The distributions, which are of

fundamental importance in applications of the binary encounter approximation to description of atomic and ionic collisions, are obtained in the form of simple analytical expressions. The quantum-classical distributions of this work are compared with several other distributions in Ne, Ar, and Al atoms in the ground state. 16 refs.

45737 Semiclassical principles of atomic and molecules spectra. Patterson, C.W. (Los Alamos National Lab., NM (USA)). pp. 1-90 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper discusses the semiclassical principles of absorption and emission of radiation where the radiation field is treated as continuous and the atomic and molecular energies are treated as discrete. Quantum transition probabilities are determined from semiclassical arguments for electric dipole radiation. The author presents line shapes, cross sections, and saturation of transitions appropriate of high-resolution spectroscopy, atomic spectroscopy, and vibrational and rotational spectroscopy of molecules.

45738 Options for generating greater than 5-eV atmospheric species. Moser, H.O.; Schempp, A. pp. 171-179 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The acceleration of cluster ion beams of species, including those occurring in the earth's atmosphere with the aim to produce intense, energetic particle beams for interaction and simulation studies, is discussed. Results on beams formed with a dc accelerator and design values of a radio-frequency quadrupole cluster ion accelerator show that, in either case, the flux densities and velocities satisfy the requirements comfortably. If the cluster ion beams can be converted effectively into atomic or molecular beams, then such facilities will be very useful to study interactions between fast particles and various targets, and to simulate spacecraft flight in low-density gas atmospheres. 13 refs.

45739 Resonance photoionization spectroscopy. Paisner, J.A. (Lawrence Livermore National Lab., CA (USA)); Solarz, R.W. pp. 175-260 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper offers a functional understanding of the principles and applications of resonance photoionization spectroscopy. Development of this branch of spectroscopy is reviewed and a theoretical description of the relevant excitation dynamics is presented.

45740 Applications for laser absorption spectroscopy. Chen, H.L. (Lawrence Livermore National Lab., CA (USA)). pp. 261-350 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper discusses the absorption technique used to measure the densities of ground and excited states of molecules, atoms, and ions. The author presents a survey of promising techniques and their developments and explains the fundamentals and development of absorption spectroscopy.

45741 Photoelectron angular distributions for *ns* (n=8–12) subshells of cesium: Relativistic effects. Cuellar, L.E. (Department of Physics, The University of Tennessee, Knoxville, TN (USA)); Compton, R.N.; Carman, H.S. Jr.; Feigerle, C.S. *Physical Review Letters (USA),* 65(2): 163-166 (9 Jul 1990). DOE Contract AC05-84OR21400.

Photoelectron angular distributions for resonantly enhanced three-photon ionization (2+1) of cesium via the *ns* (n=8–12) states have been measured. The asymmetry parameter β is found to vary from +1.2 for the 8*s* state to −0.5 for the 12*s* state. These results provide the first clear experimental evidence for relativistic (spin-orbit) effects on the photoelectron angular distribution for an alkali-metal atom.

45742 Identification of $H_2(v'')$ vibrational excitation processes in a hydrogen discharge. Hiskes, J.R. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550 (USA)). *Applied Physics Letters (USA),* 57(3): 231-233 (16 Jul 1990). DOE Contract W-7405-ENG-48. Contract AFOSR-ISSA-89-0039.

The enhancement of the $H_2(v'')$ vibrational distribution observed in the medium-density hydrogen discharge of Eenshuistra and co-workers is investigated theoretically as a function of different excitation processes. The observed fivefold enhancement of the v''=5 population with increasing discharge current is reproduced in the model. Principal excitations generating this enhancement are H^+_3surface recombination and fast-electron excitation. Atom-surface recombination may be a principal contributor near the v''=1 portion of the spectrum.

45743 Observation of high-lying resonances in the H^- ion. Harris, P.G. (The University of New Mexico, Albuquerque, New Mexico 87131 (USA)); Bryant, H.C.; Mohagheghi, A.H.; Reeder, R.A.; Sharifian, H.; Tang, C.Y.; Tootoonchi, H.; Donahue, J.B.; Quick, C.R.; Rislove, D.C.; Smith, W.W.; Stewart, J.E. *Physical Review Letters (USA),* 65(3): 309-312 (16 Jul 1990).

Several series of doubly excited resonances have been observed in H^- photodetachment, appearing as dips in the production cross section of excited neutral hydrogen. At least three resonances are clearly visible converging on each of the thresholds n=5, 6, 7, and 8. The data support recent theoretical calculations for the energies of doubly excited resonances and verify a Rydberg-dipole formula for the main resonance positions.

45744 A search for anomalies in the palladium-deuterium system. Gillespie, D.J. (Naval Research Lab., Washington, DC (USA)); Kamm, G.N.; Ehrlich, A.C.; Mart, P.L. *Fusion Technology (USA),* 16(4): 526-528 (Dec 1989).

A polycrystalline palladium rod is electrolytically charged with deuterium up to a deuterium/palladium ratio of 0.81 while several sample parameters are simultaneously measured in situ, including electrical resistivity, sample dimensions, cell temperature, and neutron production. Various charging rates are used in an attempt to provoke any anomalous behavior, such as a previously unknown crystallographic or chemical phase change, that might account for reports of heat or neutron production. Neither the electrical resistivity nor sample dimensions manifest evidence of any anomaly.

45745 Time-dependent aspects of electron degradation. V. Ar-H_2 mixtures. Kowari, K. (Argonne National Laboratory, Argonne, IL (USA)); Inokuti, M.; Kimura, M. *Physical Review, A (General Physics) (USA),* 42(2): 795-802 (15 Jul 1990). DOE Contract W-31109-ENG-38.

Time-dependent electron degradation spectra and yields of initial products are studied for the Ar-H_2 mixture by using the time-dependent Spencer-Fano (TDSF) theory. An integral form of the TDSF equation is derived and applied in numerical solutions. The present study shows, in the time-dependent context, that addition of a small amount of H_2 in Ar greatly enhances the yield of the triplet states of H_2 because of the presence of subexcitation electrons whose energies are below the electronic excitation threshold of Ar. The production of the triplet states is slow; it takes a period ten times longer than fast processes such as ion production. Secondary processes such as ion-molecule reactions following the electron degradation process are also discussed.

45746 Photoionization of hydrogen atoms near the ionization threshold. Norwood, K. (Ames Laboratory, U.S. Department of Energy, Ames, IA (USA)); Ng, C.Y.; Vary, J.P. *Journal of Chemical Physics (USA),* 93(2): 1480-1481 (15 Jul 1990). DOE Contract W-7405-ENG-82.

The photoionization cross sections for the hydrogen atom were measured in the wavelength range from 700–920 Angstroms. It was found that the experimental results agree with the theoretical predictions.(AIP)

45747 On shape asymmetry of Gaussian molecules. Wei, G. (Department of Chemistry, BG-10, University of Washington, Seattle, WA 98195 (USA)); Eichinger, B.E. *Journal of Chemical Physics (USA),* 93(2): 1430-1435 (15 Jul 1990). DOE Contract FG06-84ER45123.

A method of calculating average moments, to an arbitrary order m, of the principal components of the gyration tensor of a Gaussian molecule imbedded in any k-dimensional space is presented. These average moments are then used in generalized shape parameters A_m of degree $m \leq k$, which measure the asymmetry of the shapes of Gaussian molecules. Simple formulas for A_2, A_3, and the average moments up to third order are given. Explicit expressions for A_2 and A_3 for linear and circular chains, regular stars with infinitely long arms, double rings of a large number of beads, and combs with many side chains are obtained, and the shape characteristics of these molecules are discussed. It is found that Gaussian molecules are, on the average, prolate rather than oblate even in an infinite dimensional space, with the exception of regular stars with densely radiated long arms which exhibit perfect symmetry. The problem of analytic characterizations of shape asymmetry of Gaussian molecules or non-self-avoiding random walks of any kind is thus solved in complete generality.

45748 Calculation of partial widths for autoionization of the ^1P ($3s3p$) resonance state of helium. Bentley, J. (Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556 (USA)); Chipman, D.M. *Journal of Chemical Physics (USA)*, 93(3): 1785-1790 (1 Aug 1990).

Partial widths for the autoionization of He^{**} ^1P ($3s3p$) into various decay channels are calculated by an analytic continuation method that makes use only of real eigenvalues from stabilization graphs. Agreement with experiment and with more elaborate theoretical calculations is satisfactory, more closely in accord with the latter where discrepancies exist.

45749 Thomson space charge in D–T gas. Souers, P.C. (Department of Chemistry and Materials Science, Lawrence Livermore National Laboratory, Livermore, California 94550 (USA)); Tsugawa, R.T.; Bisson, C.L.; Wolfer, W.G. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3314-3318 (Jul 1990). DOE Contract W-7405-ENG-48.

Space-charge electrical conductivity data for 0.1% tritium in deuterium gas is compared to the predictions made by the J. J. Thomson theory of 1899. While this theory is in no way competitive with a full computer model, it is simple and physically illustrates the problem. Thomson's theory fails at high potentials where the electric charges are swept out. At the lowest potential of 0.1 V, the recombination coefficient from Thomson's theory agrees with the correct value given by the computer model's fit of the data.

45750 Experimental and model angular distributions of one- and two-electron capture processes in 0.5–20 eV/u Ar^{4+}-Ar collisions. Biedermann, C. (Department of Physics, University of Tennessee, Knoxville, TN (USA)); Cederquist, H.; Andersson, L.R.; Levin, J.C.; Short, R.T.; Elston, S.B.; Gibbons, J.P.; Andersson, H. *Physical Review, A (General Physics) (USA)*, 41(11): 5889-5908 (1 Jun 1990). DOE Contract AC05-84OR21400.

We have measured and calculated state-resolved angular distributions of one- and two-electron-capture processes in 0.5–20 eV/u Ar^{4+}-Ar collisions. The experimental energy-gain spectra show single-electron capture to six unresolved $4p$ LS terms, while no trace of a $4s$ population was found for laboratory collision energies below 200 eV. Semiclassical trajectory calculations, using a seven-channel Landau-Zener model for the probability flux on the multivalued deflection functions, show that the oscillations in the experimental $4p$ angular differential cross section are due to multiple rainbow scattering and that interference effects play a limited role. Experimental and calculated $4p$ angular distributions compare nicely over the whole energy range. For energies above 150 eV, true double-capture and transfer ionization with angular distributions consistent with a two-step electron-transfer process appear within the $\pm 9°$ experimental acceptance.

45751 Theoretical study of ion-pair formation and Penning and associative ionization in low- to intermediate-energy $He^*(2\,^{1,3}S)$+Li collisions. Kimura, M. (Argonne National Laboratory, Argonne, Illinois 60439 (USA)); Lane, N.F. *Physical Review, A (General Physics) (USA)*, 41(11): 5938-5942 (1 Jun 1990). DOE Contract W-31109-ENG-38.

A semiclassical treatment based on a molecular orbital expansion is used to study ion-pair formation and Penning- and associative-ionization processes in $He^*(2\,^{1,3}S)$+Li collisions in the energy regime from 100 to 1000 eV. Although these processes are usually important in different energy ranges, here they are found to compete with each other to an appreciable degree and hence to provide a rare opportunity for investigating collision dynamics that require an equal-footing treatment between autoionization to the continuum and a discrete transition. The present cross sections for these processes compare favorably with the measurement of Wang, Tang, and Neynaber [J. Phys. B 20, 1527 (1987)].

45752 Further studies of H^- photodetachment in electric fields. Harris, P.G. (The University of New Mexico, Albuquerque, New Mexico 87131 (USA)); Bryant, H.C.; Mohagheghi, A.H.; Tang, C.; Donahue, J.B.; Quick, C.R.; Reeder, R.A.; Cohen, S.; Smith, W.W.; Stewart, J.E.; Johnstone, C. *Physical Review, A (General Physics) (USA)*, 41(11): 5968-5973 (1 Jun 1990).

The results are presented of further studies of the effects of electric fields on the photodetachment cross section of H^-, for both π and σ polarization. Data are fitted to the theory of Rau and Wong [Phys. Rev. A 37, 632 (1988)], which predicts a modulation about the zero-field cross section. Agreement is good for π polarization, but the predicted profile for σ polarization does not appear to match the data quite as well.

45753 Influence of a finite scattering volume on the determination of electron-impact coherence parameters. Zetner, P.W. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109 (USA)); Trajmar, S.; Csanak, G. *Physical Review, A (General Physics) (USA)*, 41(11): 5980-5999 (1 Jun 1990).

Superelastic electron scattering from laser-excited $^{138}Ba(\ldots 6s6p\ ^1P)$ is investigated both theoretically and experimentally. The theoretical framework is developed and incorporated into a model of a realistic scattering geometry of finite spatial extent. Model calculations predict that the dependence of the superelastic scattering intensity on the linear polarization direction of the laser beam can be severely distorted due to the existence of a finite scattering volume. Our measurements confirm the presence of this distortion and are well described by the model calculations. Conclusions are drawn concerning the influence of this effect on the extraction of electron-impact coherence parameters.

45754 Uniform quantization conditions in the presence of symmetry: The rotational spectrum of SF_6. Robbins, J.M. (Department of Physics, University of California, Berkeley, California 94720 (USA)); Creagh, S.C.; Littlejohn, R.G. *Physical Review, A (General Physics) (USA)*, 41(11): 6052-6062 (1 Jun 1990). DOE Contract AC03-76SF00098.

Uniform semiclassical quantization conditions are obtained for a one-dimensional Hamiltonian possessing octahedral symmetry. The Hamiltonian describes the rotational dynamics of SF_6, a system in which tunneling plays an important role. Quantization conditions are obtained for each symmetry class. These are shown to agree with previously obtained primitive quantization conditions in the small tunneling limit and to reproduce a characteristic periodicity in the symmetries labels. Quantum and semiclassical eigenvalues are computed numerically. Near the classical separatrix the uniform quantization provides orders of magnitude improvement in accuracy over primitive quantization. Our calculation is based on periodic orbit theory, modified here to include classically forbidden reflections and transmissions, and completes a study undertaken in a previous paper. The methods used may be generalized to other Hamiltonians and symmetry groups.

45755 Strong-field ionization in classical and quantum dynamics. Ritchie, B. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550 (USA)); Bowden, C.M.; Sung, C.C.; Li, Y.Q. *Physical Review, A (General Physics) (USA)*, 41(11): 6114-6118 (1 Jun 1990). DOE Contract W-7405-ENG-48.

Classical and quantum results for the strong-electromagnetic-field ionization of the ground state of a generic model are compared. Quantum results are also presented for the strong-field ionization of the hydrogen atom. These results demonstrate that ionization depends strongly on the phase of the field in such a way

that the interaction potential acts as a barrier or well at large distances from the binding region, producing effectively a closed or open "gate" to the region of space outside the atom. The open gate is analogous to a strong, static electric field applied to an atom such that the atom ionizes classically. Quantum and classical ensemble results for the ionization probability are found to show close qualitative agreement. Other comparisons are made for classical versus quantum wave-packet trajectories.

45756 Electron-impact-ionization cross-section measurements for Ti^{11+} and Cr^{13+}. Gregory, D.C. (Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN (USA)); Wang, L.J.; Swenson, D.R.; Sataka, M.; Chantrenne, S.J. *Physical Review, A (General Physics) (USA)*, 41(11): 6512-6514 (1 Jun 1990). DOE Contract AC05-84OR21400.

Absolute cross sections for ionization of the Na-like ions Ti^{11+} and Cr^{13+} due to electron impact have been measured over the energy ranges 300–800 eV and 500–1500 eV, respectively. These measurements confirm predictions by Griffin, Pindzola, and Bottcher [Phys. Rev. A 36, 3642 (1987)] concerning the magnitude of indirect processes for these ions.

6404 Fluid Physics

Refer also to citation(s) 44980, 46135, 46169, 46257

45757 (LA-UR–90-2437) **Optimum hypersonic airfoil with power law shock waves.** Wagner, B.A. Los Alamos National Lab., NM (USA). [1990]. 10p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-9010154–1: 1. international hypersonic waverider symposium, College Park, MD (USA), Oct 1990). Order Number DE90014903. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In the present paper the flow field over a class of two-dimensional lifting surfaces is examined from the viewpoint of inviscid, hypersonic small-disturbance theory (HSDT). It is well known that a flow field in which the shock shape S(x) is similar to the body shape F(x) is only possible for $F(x) = x^k$ and the freestream Mach number $M_\infty = \infty$. This self-similar flow has been studied for several decades as it represents one of the few existing exact solutions of the equations of HSDT. Detailed discussions are found for example in papers by Cole, Mirels, Chernyi and Gersten and Nicolai but they are limited to convex body shapes, that is, $k \leq 1$. The only study of concave body shapes was attempted by Sullivan where only special cases were considered. The method used here shows that similarity also exists for concave shapes and a complete solution of the flow field for any $k > 2/3$ is given. The effect of varying k on $C_L^{3/2}/C_D$ is then determined and an optimum shape is found. Furthermore, a wider class of lifting surfaces is constructed using the streamlines of the basic flow field and analysed with respect to the effect on $C_L^{3/2}/C_D$. 9 refs., 3 figs.

45758 Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Progress in Astronautics and Aeronautics. Volume 116. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. 590p. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Various papers on space-related applications of rarefied gas dynamics are presented. Individual topics addressed include: semiclassical approach to atomic and molecular interactions, options for generating greater than 5 eV atmospheric species, backscatter contamination analysis, rarefied gas flow through rectangular tubes and tubes of various surface properties, translational nonequilibrium effects in expansion flows of argon, three-dimensional freejet flow from a finite length slit, simulation of multicomponent nozzle flows into a vacuum, radially directed underexpanded jet from a ring-shaped nozzle, three-dimensional structures of interaction freejets, particle surface interaction in the orbital context, determination of momentum accommodation from satellite objects, nonreciprocity in noble gas metal-surface scattering, thermal accommodation and conduction in the transition regime, models for temperature jumps in vibrationally relaxing gases.

45759 Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Progress in Astronautics and Aeronautics. Volume 118. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. 637p. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Among the areas covered are kinetic theory, discrete kinetic theory, direct simulations, numerical techniques, and flowfields. The topics discussed include various problems for the Boltzman equation, such as initial and boundary values, the collision integral, and stationary flows. Discrete-velocity gases, molecular dynamics calculations of transport properties, and multispeed cellular automation are among the topics discussed within the framework of the discrete kinetic theory. Attention is given to numerical methods in rarefied gasdynamics, statistical fluctuations in Monte Carlo calculations, and rarefield normal shocks. Emphasis is placed on numerical solutions for the Boltzman equation, as well as on Monte Carlo solutions. Three-dimensional flows, hypersonic flows, transitional flows, and wake flows are also analyzed.

45760 Monte Carlo simulation of electron swarm in a strong magnetic field. Koura, Katsuhisa. pp. 76-88 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Electrons swarms in rare gases under the influence of strong magnetic fields are studied using the null-collision test particle Monte Carlo method. The results confirm that the conventional two-term expressions for the swarm parameters derived from the Boltzmann equation in the absence of electronic excitations and ionizations are sufficiently accurate even for a strong magnetic field. 12 refs.

45761 Collisional transport in magnetoplasmas in the presence of differential rotation. Tessarotto, M.; Catto, P.J. pp. 89-101 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The model of Catto et al. (1987) is extended to address the problem of the relaxation of plasma relative toroidal rotation. It is found that a correct description of this relaxation process requires a generalization of the drift-kinetic equation in order to include first-order velocity perturbations with respect to a Larmor radius expansion. Inspection of appropriate moment equations shows that in a transport regime, first-order velocity perturbations are uniquely determined in terms of the relevant thermodynamical forces in that they decay on a time scale comparable to that of ordinary collisional transport. 6 refs.

45762 Diffusion of a particle in a very rarefied gas. Gaveau, B.; Gaveau, M. pp. 61-69 of Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

An exact stochastic equation is derived for the momentum transfer per collision for a test particle interacting with a very rarefied gas of hard spheres in equilibrium at temperature T. This result is obtained without any assumption on the mass ratio of particles and is a Langevin-type equation with a friction term and a stochastic force. The covariance matrix of this noise force is different from the covariance of the white noise force in Langevin equation, since in our case it depends on the test particle momentum before collision. Finally, when the number of collisions undergone by the test particle increases, average and variance of its momentum tend to their values at equilibrium at temperature T. 8 refs.

45763 Bifurcating families of periodic traveling waves in rarefied plasmas. Holloway, J.P. (Southern California Univ., Los Angeles, CA (USA)); Dorning, J.J. pp. 115-126 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

A necessary condition for the existence of undamped spatially periodic traveling waves near spatially uniform equilibria is derived. When the necessary condition is satisfied, a bifurcation analysis of Berstein-Greene-Kruskal modes is used to construct branches of such waves with wavelength equal to the fundamental wavelength. Expansions of the bifurcating potential for these waves are derived, and the reconstruction of the distribution function is discussed. 8 refs.

45764 Development of a low-power, high velocity atomic oxygen source. Stark, J.P.W.; Kinnersley, M.A. pp. 156-170 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The determination of gas/surface interactions appropriate to space vehicle applications requires laboratory-based measurements using a high-velocity neutral atomic oxygen source. The development of this type of source is discussed, based on the seeded arcjet principle, where a low-molecular-weight carrier gas (helium) is used in conjunction with an appropriate seed gas. Results are presented concerning the use of several seed gases in order to identify different reactions that may be useful in the efficient production of atomic oxygen. A variety of gases have been studied separately and in conjunction with other gases, including nitrous oxide both as sole source of atomic oxygen and jointly with arc-produced atomic nitrogen. 15 refs.

45765 On discrete kinetic theory with multiple collisions - Plane six-velocity model and unsteady Couette flow. Longo, E.; Monaco, R. pp. 118-130 of Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

A discrete plane six-velocity model of the Boltzmann equation with binary and triple collisions is studied. The kinetic evolution equation is derived and the thermodynamic equilibrium state is discussed. As an application, the unsteady Couette flow problem is examined. 8 refs.

45766 Monte Carlo simulation on mass flow reduction due to roughness of a slit surface. Usami, M.; Fujimoto, T.; Kato, S. pp. 283-297 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Mass flow reduction of rarefied gas through a two-dimensional slit due to roughness of the slit surface is investigated numerically. Though the direct simulation Monte Carlo method is very effective in an analysis of rarefied gas flow, it costs a lot of CPU time, especially for the near-continuum regime. Recently, some supercomputers with vector processors are available that allow high-speed calculations. To use them in the most effective way, a computer program must be adequately vectorized. By frequent use of a programming technique called 'data collection', a simulation program eight times faster than a conventional one is obtained. Applying this program to flow through a slit, the effect of surface roughness on rarefied gas flow in the transition regime has been clarified. The numerical results are compared with those of experiment. 7 refs.

45767 Validation of MCDS by comparison of predicted with experimental velocity distribution functions in rarefied normal shocks. Pham-Van-Diep, G.C. (Southern California Univ., Los Angeles, CA (USA)); Erwin, D.A. pp. 271-283 of Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

Velocity distribution functions in normal shock waves in argon and helium are calculated using Monte Carlo direct simulation. These are compared with experimental results for argon at M = 7.18 and for helium at M = 1.59 and 20. For both argon and helium, the variable-hard-sphere (VHS) model is used for the elastic scattering cross section, with the velocity dependence derived from a viscosity-temperature power-law relationship in the way normally used by Bird (1976). 6 refs.

45768 Modification of the Simons model for calculation of nonradial expansion plumes. Boyd, I.D. (Southern California Univ., Los Angeles, CA (USA)); Stark, J.P.W. pp. 327-339 of Rarefied gas dynamics: Space-related studies; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The Simons model is a simple model for calculating the expansion plumes of rockets and thrusters and is a widely used engineering tool for the determination of spacecraft impingement effects. The model assumes that the density of the plume decreases radially from the nozzle exit. Although a high degree of success has been achieved in modeling plumes with moderate Mach numbers, the accuracy obtained under certain conditions is unsatisfactory. A modification made to the model that allows effective description of nonradial behavior in plumes is presented, and the conditions under which its use is preferred are prescribed. 13 refs.

45769 Direct numerical solution of the Boltzmann equation for complex gas flow problems. Yen, S.M. (Southern California Univ., Los Angeles, CA (USA)); Lee, K.D. pp. 337-342 of Rarefied gas dynamics: Theoretical and computational techniques; International Symposium, 16th, Pasadena, CA, July 10-16, 1988, Technical Papers. Muntz, E.P.; Weaver, D.P.; Campbell, D.H. American Institute of Aeronautics and Astronautics, Inc., Washington, DC (US) (1989). (CONF-880781–: 16. international symposium on rarefied gas dynamics, Pasadena, CA (USA), 11-15 Jul 1988).

The parallel processing and multiprocessing capability of supercomputers ideally accommodates the computation strategy for solving the Boltzmann equation for rarefied gas flow problems. This strategy is to decouple the calculations in the velocity space from those in the physical space. Plans for revising the method to solve more complex problems are: (1) apply a method of integration to solve the Boltzmann equation for multidimensional problems, (2) implement the Monte Carlo method to evaluate the collision integral for both self-collisions and cross-collisions, and (3)incorporate inelastic collision into the Monte Carlo method.

45770 Waves in plasmas: Highlights from the past and present. Stix, T.H. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543 (USA)). *Physics of Fluids B (USA)*, 2(8): 1729-1743 (Aug 1990). DOE Contract AC02-76CH03073.

To illustrate the development of some fundamental concepts in plasma waves, a number of experimental observations, going back over half a century, are reviewed. Particular attention is paid to the phenomena of dispersion, collision-free damping, ray trajectories, amplitude transport, plasma wave echoes, finite-Larmor-radius and cyclotron and cyclotron-harmonic effects, nonlocal response, and mode conversion; to the straight-trajectory approximation and two-level phase mixing; and to quasilinear diffusion and its relation to radio-frequency heating, current drive, and induced neoclassical transport, and to stochasticity and superadiabaticity. Not only is the constructive interplay between experiment and theory noted, but

also that major advances have come from each of the many disciplines that invoke plasma physics as a tool, including radio communication, astrophysics, controlled fusion, space physics, and basic research.

45771 Equation of state of hard *D*-dimensional hyperspheres. Luban, M. (Ames Laboratory—Department of Physics, Iowa State University, Ames, Iowa 50011 (USA)); Michels, J.P.J. *Physical Review, A (General Physics) (USA)*, 41(12): 6796-6804 (15 Jun 1990).

We present an expression providing an accurate representation, for all densities, of Monte Carlo–molecular-dynamics (MCMD) equation-of-state data for the fluid phase of hard *D*-dimensional hyperspheres (*D*-spheres), with $D=2$–5. This expression incorporates the exact values of the virial coefficients B_2, B_3, B_4, and two constants determined from the MCMD data.

45772 Linear theory of uncompensated thermal blooming in turbulence. Chambers, D.H. (Lawrence Livermore National Laboratory, P.O. Box 808, L-495, Livermore, California 94550 (USA)); Karr, T.J.; Morris, J.R.; Cramer, P.; Viecelli, J.A.; Gautesen, A.K. *Physical Review, A (General Physics) (USA)*, 41(12): 6982-6991 (15 Jun 1990).

A linearized theory of small perturbations in thermal blooming gives a surprisingly accurate description of the initial evolution of a plane wave propagating through an absorbing fluid medium. In the case of constant absorption and fluid velocity, a sinusoidal perturbation of the optical field grows quasiexponentially at a rate determined by its Fresnel number and the accumulated optical-path difference due to blooming. Perturbations with small transverse length scales grow more rapidly than those with large length scales. The evolution of the optical field and spectrum in the presence of optical turbulence is accurately described. The growth of the small-scale fluctuations eventually leads to a decrease in plane-wave amplitude. This growth puts an ultimate limit on the amount of power that can be propagated through a turbulent medium such as the atmosphere. More complicated cases with varying absorption and velocity profiles can be analyzed using a WKB approximation. Numerical simulations show growth suppression when the velocity varies along the optical path. These predictions from the linearized theory agree well with results from numerical simulations of the full nonlinear system and thus provides a standard for comparing different numerical codes.

6450 High Energy Physics

Refer also to citation(s) 45891, 45909

45773 (BNL–44001) **[The worldwide HEPVM collaboration]: Foreign trip report, March 12–23, 1988.** Lawrence, L.L. Brookhaven National Lab., Upton, NY (USA). 4 Apr 1988. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015219. Source: NTIS, PC A03/MF A01 - OSTI.

The Technical Committee meetings at CERN covered VM/CP mods, VM/CMS mods and VMSETUP, the HEPVM magnetic tape manager for CMS. Two themes prevailed. One, essentially our charter, is to harmonize those areas of VM that are important to HEP computing. The other is to reduce our dependence on system modifications used to implement facilities (in these areas) as IBM closes the window on source code with their OCO policy. The Steering Committee meeting at INFN, Pisa, Italy, had a full agenda in several broad areas: site status and plans for the next year; review reports from Technical Committees and User Forums; roundtable discussions of futures; and discuss position in dealing with IBM on OCO issues.

45774 (BNL–44002) **[Technical development of HEPVM software within the VM environment]: Foreign trip report, March 12–March 23, 1988.** McFadden, E.J. Jr. Brookhaven National Lab., Upton, NY (USA). 4 Apr 1988. 87p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015217. Source: NTIS, PC A05/MF A01 - OSTI.

This trip was comprised to two segments; working technical meetings with other Computer Analysts from the HEPVM collaboration, and participation within HEPVM steering group. The technical discussions took place at CERN during the week of March 14 through 18, 1988, followed by the steering group meeting in Pisa on March 21 and 22, 1988.

45775 (LBL–29115) **Monte Carlo programs and other utilities for high energy physics.** Palounek, A.P.T. (Lawrence Berkeley Lab., CA (USA)); Youssef, S. Lawrence Berkeley Lab., CA (USA). May 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016636. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Software Standards and Documentation Group of the Workshop on Physics and Detector Simulation for SSC Experiments has compiled a list of physics generators, detector simulations, and related programs. This is not meant to be an exhaustive compilation, nor is any judgment made about program quality; it is a starting point or a more complete bibliography. Where possible we have included an author and source for the code. References for most programs are in the final section.

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 44953, 45811, 45898, 45936, 45937, 45975

45776 (BNL–44038) **[1987 International symposium on lepton and photon interactions at high energy]: Foreign trip report, July 25–August 6, 1987.** Tanaka, Mitsuyoshi. Brookhaven National Lab., Upton, NY (USA). 17 Aug 1987. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015215. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers the activities as an attendee at the 1987 International Symposium on Lepton and Photon Interactions at High Energy and Visit to CERN, Geneva, Switzerland.

45777 (BNL–44039) **[1987 International symposium in lepton and photon interactions at high energy]: Foreign trip report, July 23–August 1, 1987.** Wanderer, P. Brookhaven National Lab., Upton, NY (USA). 8 Aug 1987. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015212. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The overall conclusion of the conference was the continuing success of the standard electro-weak model, but with no firm direction available as to how to proceed to the next level of unification. The first from the Collider Detector Facility (CDF) at Fermilab and the four detectors at Tristan Collider at KFK in Japan were presented. The CDF data were too preliminary for a physics result. The Tristan data appear to rule out a top quark at this energy. At the University of Paris, analysis continues on AGS Experiment 816 with a possible conclusion by the end of the year. Discussions after my talk on the SSC indicated uncertainty as to whether the energy of the proposed CERN pp Collider LHC would be high enough. At DESY, the Magnet Measurement Group is making good progress in the construction and debugging of the equipment for measuring the HERA proton-ring magnets.

45778 (BNL–44942) **Antimatter, strangeness and exotic objects at RHIC [relativistic heavy ion collider].** Dover, C.B. Brookhaven National Lab., Upton, NY (USA). Aug 1990. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900601–5: 12. international conference on particles and nuclei, Cambridge, MA (USA), 24-29 Jun 1990). Order Number DE90016315. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We investigate the production of multiply strange composite objects and their antiparticles in collisions at the relativistic heavy ion collider RHIC.

45779 (BNL–44954) **Search for the decay $K_L^0 \rightarrow \pi^0 e^+ e^-$.** Morse, W.M. (Brookhaven National Lab., Upton, NY (USA)); Leipuner, L.B.; Larsen, R.C.; Jastrzembski, E.; Adair, R.K.; Greenlee, H.B.; Kasha, H.; Mannelli, E.B.; Ohl, K.E.; Schmidt, M.P.; Vagins, M.R.; Schwarz, C.B. Brookhaven National Lab., Upton, NY (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900601–4: 12. international conference on particles and nuclei, Cambridge, MA (USA),

24-29 Jun 1990). Order Number DE90016322. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Results are presented of a recent search by AGS Experiment 845 for the CP violating decay $K_L^0 \rightarrow \pi^0 e^+ e^-$. The 90% C.L. limit $B(K_L^0 \rightarrow \pi^0 e^+ e^-) < 5.5 \times 10^{-9}$ was obtained. The background to the $\pi^0 e^+ e^-$ search, $K_L^0 \rightarrow e^+ e^- \gamma$ with an internal bremsstrahlung is discussed. 5 refs., 1 fig.

45780 (CONF-900331–13) **Investigation into the feasibility of a soft muon experiment.** Tincknell, M.L. Oak Ridge National Lab., TN (USA). Jun 1990. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on heavy ion physics at the alternating gradient synchrotron; Upton, NY (USA); 3-7 Mar 1990. Order Number DE90015541. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Issues relevant in a soft (< 5 GeV) muon pair experiment at the AGS or the RHIC central region are investigated. Observation of direct muon pairs is difficult because the muon pair to pion ratio is o (10^{-4}). Absorber penetration is the only means available to identify high energy muons among a large number of hadrons. Three important sources of background are sail-through hadrons that fail to interact in the absorber, the decays of pions and kaons to muons in the absorber, and leakage of hadronic shower products through the absorber. An absorber thick enough to limit the ratio of combinatorical background pairs to pions to o (10^{-4}) imposes a significant muon kinetic energy threshold due to muon range in the absorber. Absorbers with low atomic number Z are preferred to keep this threshold low, and to avoid loss of invariant mass resolution due to energy loss straggling and multiple coulomb scattering. Long-lived meson to muon decays can be directly suppressed only by picking an absorber with short interaction length, which implies a high density, high Z material. With sufficiently high statistics, a subtraction of the spectra of like-sign pairs from the spectrum of opposite-sign pairs should recover the direct muon pair spectrum. 9 refs., 9 figs., 2 tabs.

45781 (CONF-9005233–3) **Coherent particle production from relativistic heavy-ion collisions.** Wu, J.S. (Oak Ridge National Lab., TN (USA)); Bottcher, C.; Strayer, M.R.; Ernst, D.J.; Kerman, A.K. Oak Ridge National Lab., TN (USA). [1990]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400 ;AC02-76ER03069. From 2. international conference on medium- and high-energy physics; Taipei (Taiwan); 8-18 May 1990. Order Number DE90015789. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The production of charged vector boson pairs from the coherent electromagnetic field of colliding nuclei is calculated within the framework of a classical field approximation. The approximation is derrived for both lepton and boson pairs in terms of two-photon Feynman diagrams. 17 refs., 4 figs.

45782 (DOE/ER/13065–634) **Bose-Einstein correlations in pion production at TRISTAN.** Walker, R.C. Rochester Univ., NY (USA). Dept. of Physics and Astronomy. 11 Jul 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER13065. (CONF-9005245–2: International workshop on correlations and multiparticle production (CAMP), Marburg (Germany, F.R.), 14-16 May 1990; UR–1176). Order Number DE90015382. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Measurements of Bose-Einstein correlations in the production of like-signed pion pairs have been made with the AMY detector at TRISTAN. An event sample of 3800 hadronic events with $\langle\sqrt{s}\rangle$ = 57.2 GeV was used. These measurements indicate a strength of the enhancement of $\lambda = 0.60 \pm 0.13 \pm 0.08$, with a typical correlation size of $R_0 = 1.18 \pm 0.17 \pm 0.10$ fm. This value of λ is consistent with measurements at lower energies; however, R_0 is somewhat larger than lower energy results have indicated. 12 refs., 3 figs.

45783 (DOE/ER/40380–2, pp. 87-93) **Parity violation program at CEBAF.** Petraitis, M. (Catholic Univ. of America, Washington, DC (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

CEBAF parity violation program will be a major test of the validity of the standard model of electroweak unification and its extensions. Parity violation measurements give combinations of coupling constants such that, after necessary radiative corrections, $\sin^2\theta_w$ can be extracted. It would also test the accuracy of some basic assumptions such as CVC and isospin invariance. 2 refs., 2 figs.

45784 (DOE/ER/40380–2, pp. 94-101) **Testing the standard model via neutral current interactions.** Rugari, S.L. (Wright Nuclear Structure Lab., New Haven, CT (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

One of the fundamental problems of high energy experimental physics today is the precision measurement of $\sin^2\theta_W$ in neutral current interactions. This parameter is predicted to be a universal parameter in the electroweak or Standard Model. A high precision measurement of $\sin^2\theta_W$ in ν-e^- scattering will ultimately test its universality. Such a measurement has been proposed at LANL using a Large Volume Cerenkov Detector (LCD). 2 refs., 2 figs.

45785 (DOE/ER/40380–2, pp. 205-211) **Non-resonant N-N pion production.** Bachman, M. (Univ. of Texas, Austin (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The simplest inelastic reaction in N - N scattering is the production of a pion. The threshold for this reaction begins at T = 280 MeV and is the only inelastic channel available up until T = 600 MeV, the threshold for two pion production. However, despite the kinematic simplicity of the reaction and its monopoly over a 320 MeV range, the mechanism for pion production is not well understood. The importance of the isospin T = O amplitudes in pion production and the experiments used to reveal them are discussed. 6 refs., 5 figs.

45786 (FNAL/C–90/138-E) **Top quark and SUSY [supersymmetric] searches at CDF.** Yeh, G.P. The CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). 17 May 1990. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9003175–3: Les Rencontres de Physique de la Vallee D'Aosta, La Thuile (Italy), 18-24 Mar 1990). Order Number DE90015183. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Searches for the top quark in $p\bar{p}$ collisions at $\sqrt{s}$ = 1.8 TeV are described. The analyses are based on data with an integrated luminosity of 4.4 pb^{-1} recorded with the Collider Detector at Fermilab in the 1988–1989 run. An upper limit on the $t\bar{t}$ cross section is obtained. The top quark with mass below 89 GeV/c^2 is excluded at the 95% CL. Prospects for searches for the top quark in the future are presented. We also briefly present results on searches for supersymmetric particles. 14 refs., 10 figs.

45787 (FNAL/C–90/139-E) **Electron identification at CDF.** Kim, Shinhong (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). The CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). 1 Jun 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9004213–4: International conference on solenoidal detectors for the SSC, Tsukuba (Japan), 23-25 Apr 1990). Order Number DE90015184. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Electron identification at CDF is performed using the information of lateral and longitudinal shower spread, the track-cluster position match and the energy-momentum match. The tracking chamber with a solenoidal magnetic field at CDF is powerful for rejecting the

backgrounds such as the $\pi^{\pm} - \pi^0$ overlaps, the π^0/γ conversions and interactive $\pi^{\pm}$ in electromagnetic calorimeter. The energy-momentum match cut can decrease the background due to the $\pi^{\pm} - \pi^0$ overlaps for non-isolated electrons with Et above 10 GeV by a factor of 20. The conversion electrons are identified using track information with an efficiency of 80 ± 3%. The charge of electrons from W decay can be determined in the pseudorapidity range of $|\eta| < 1.7$ at CDF. The charge determination is useful for background estimation of Drell-Yan physics and heavy flavor physics. 5 refs., 5 figs.

45788 (FNAL/C–90/146-E) **Recent results from proton-antiproton colliders.** Geer, S. (Harvard Univ., Cambridge, MA (USA). High Energy Physics Lab.). Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1990. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-900367–1: 1. international symposium on particles, strings and cosmology, Boston, MA (USA), 27-31 Mar 1990). Order Number DE90015624. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

New results from the CERN and Fermilab proton-antiproton colliders are summarised. The areas covered are jet physics, direct photon production, W and Z production and decay, heavy flavor production, the search for the top quark, and the search for more exotic phenomena. 46 refs., 20 figs., 4 tabs.

45789 (IPNO-DRE–89-11) **Experimental search for B=2, T=2 bound states around the πNN threshold.** Willis, N. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Comets, M.P.; Bimbot, L.; Courtat, P.; Le Bornec, Y.; Loireleux, E.; Reide, F.; Tatischeff, B.; Moalem, A.; Moalem, A.; Arvieux, J.; Boivin, M.; Chisholm, A.; Bergdolt, A.M.; BergdoParis-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 9p. Order Number DE90514627. Source: NTIS (US Sales Only), PC A02/MF A01.

The differential cross section and analyzing power have been measured for the $p(p,\pi^-)X$ reaction at an incident energy of 1450 MeV and a pion angle of 13.8° in order to study eventual dibaryonic T=2 structures in the vicinity of the πNN threshold. No statistically significant evidence for such structures corresponding to πNN bound states or 6-quark states could be established. Upper limits to the cross section are deduced. Analyzing power data are discussed.

45790 (IPNO-DRE–89-14) **Searching for the quarks and gluons plasma.** Gerschel, C. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Kluberg, L. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 17p. (In French). Order Number DE90514626. Source: NTIS (US Sales Only), PC A03/MF A01.

Some investigations involving quark matter, at CERN, are discussed. The CERN available oxygen and sulfur beams, with energy about 200 GeV/nuclei, allow the obtention of high energy densities, never reached before. The possibilities of investigating (at CERN) the quarks and gluons plasma are considered. The first and unexpected results obtained from the NA38 experiment are overviewed.

45791 (LA–11842-P) **A proposal to search for neutrino oscillations with high sensitivity in the appearance channels $\nu_\mu \rightarrow \nu_e$ and $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$.** Lu, X-Q. (California Univ., Irvine, CA (USA)); Yodh, G.; Fung, S.Y.; Kang, J.H.; Shen, B.C.; VanDalen, G.J.; Carlini, R.C.; Napolitano, J.J.; Amann, J.; Baer, H.; Burman, R.; Donahue, J.; Foreman, W.; Garvey, G.T.; Hoehn, M.; Kozlowski, T.; Lee, D.M.; LouiLos Alamos National Lab., NM (USA). Aug 1990. 166p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90014841. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

An experiment is proposed to search concurrently for $\nu_\mu \rightarrow \nu_e$ and $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$ oscillations with high sensitivity at LAMPF. The detector consists of a tank with 200 tons of dilute liquid scintillator with 850 10-in. photomultiplier tubes mounted on the inside tank covering 28% of the surface. Both Cerenkov light and scintillation light will be detected. The tank will reside inside the existing E645 veto shield and the experiment will make use of the present A6 beam-stop neutrino source. After two years of data collection, 90% confidence level limits on $\bar{\nu}_{mu}(\nu_\mu) \rightarrow \bar{\nu}_e(\nu_e)$ mixing strengths of $2.7(2.7) \times 10^{-4}$ can be obtained for all $\Delta m^2 > 1$ eV^2. Similarly, for maximal mixing the 90% C.L. limits on Δm^2 are $1.7(4.0) \times 10^{-2}$. This experiment will, therefore, provide the world's best terrestrial limits on $\nu_\mu \rightarrow \nu_e$ oscillations. Other physics to be obtained includes measurements of the charged current reactions $\nu_e C \rightarrow e^- N$ and $\nu_\mu C \rightarrow \mu^- N$, of the inelastic neutral current reaction $\nu C \rightarrow \nu C^*$ (15.11- MeV γ), and a search for the rare decays $\pi^0 \rightarrow \nu\bar{\nu}$ and $\eta \rightarrow \nu\bar{\nu}$.

45792 (LAL–89-11) **Study of the atmospheric neutrino oscillations in the Frejus experiment.** Perdereau, O. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. May 1989. 214p. (In French). Order Number DE90514634. Source: NTIS (US Sales Only), PC A10/MF A01.

The behavior of atmospheric neutrinos is investigated. It is a zero mass, zero charge and weak interacting particle. The aim of the investigation is to search for non standard phenomena, such as neutrino oscillations. The neutrino theoretical properties are discussed and the physical parameters experimental limits are recalled. The analysis of the approximately 200 events from atmospheric neutrinos observed in Frejus detector is carried out. The results and simulation of neutrino interactions are presented. The data analysis induces to the exclusion of neutrino oscillation hypothesis from some models. Three cases of oscillations involving two neutrino flavors are analyzed. The effect of a third flavor is also taken into account. The present data and those from IMB and Kamiokande experiments are compared. Topics involving investigations on the superposition of a signal and the atmospheric neutrinos are included.

45793 (LAL–89-13) **CP violation in the K^0 - anti K^0 system. Study of the background noise minimization by means of a transition radiation detector.** Harrus, I. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. May 1989. 111p. (In French). Order Number DE90514631. Source: NTIS (US Sales Only), PC A06/MF A01.

This work has been performed for the NA31 experiment at CERN whose goal is a high precision mesurement of the parameter ϵ'/ϵ reflecting direct CP-violation in the K^0 - anti K^0 system. This work is concerned with the calibration and the study of the performance of the transition radiation detector, TRD, added recently to the experiment. The TRD provides an important increase in the pion/electrons separation. This allows a significant reduction in the systematic uncertainty in the background subtraction of the $K_L{}^0$ to two charged pions decay mode which is dominated by semileptonics decays. A complete calibration of this detector has been performed. Energy pulseheight response for various detectors parameters are reviewed. After all corrections, electron rejection efficiency is shown. We analyse then, the semi-leptonic charged background.

45794 (LAL–89-23) **Study of atmospheric neutrino interactions with the Frejus detector.** Frejus Collaboration. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Aug 1989. 11p. Order Number DE90514611. Source: NTIS (US Sales Only), PC A03/MF A01.

We present an analysis of the neutrino event sample recorded in the Frejus experiment. This sample which corresponds to the 1.56 kt.y final sensitivity of the experiment is compared to the predictions of a Monte Carlo neutrino simulation program. It is based on a recent calculation of the atmospheric neutrino flux at the Frejus latitude which takes into account muon polarization effects. The comparison is performed on the distributions of the visible energy, the zenith angle and the neutrino flavor. Good agreement is obtained between the data and the simulation within statistics.

45795 (LAL–89-24) **An unambiguous search for a light Higgs boson.** Davier, M.; Nguyen Ngoc, H. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jul 1989. 13p. Order Number DE90514612. Source: NTIS (US Sales Only), PC A03/MF A01.

A search for light Higgs bosons has been performed in an electron beam-dump experiment. No positive signal is observed which allows us to reject at 90% CL the existence of a standard Higgs in the range from 1.2 to 52 MeV. Non-standard Higgs bosons are also excluded in a large range of couplings. This search relies on the well controlled and calculable process of bremsstrahlung from electrons in the Coulomb field of large Z nuclei. Both production

and decay are governed by the single coupling constant of Higgs to electrons.

45796 (LAL–89-26) **Study of some K^0 rare decay processes in NA31.** Auge, E. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. 1989. 10p. (CONF-8905219-: Conference on CP violation in particle physics and astrophysics, Blois (France), 22-26 May 1989). Order Number DE90514613. Source: NTIS (US Sales Only), PC A02/MF A01.

The large amount of data accumulated by the NA31 collaboration in order to measure Direct CP Violation in the $K^0 \rightarrow 2\ \pi$ decays can also be used to study some rare K_L and K_S decays. A search for the decay $K_L \rightarrow \pi^0 e^+ e^-$ is presented, together with a search for the sequence $K_L \rightarrow \pi^0\ H^0$ followed by $H^0 \rightarrow e^+ e^-$, where H^0 would be a scalar boson. The prospects for studying the decays $K_L \rightarrow \pi^0\ \gamma\gamma$ and $K_L \rightarrow \gamma e^+ e^-$ are presented. A new limit on the decay $K_S \rightarrow e^+ e^-$ is also given.

45797 (LAL–89-27) **NA14' results on D_S decays.** Wormser, G. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Aug 1989. 7p. (CONF-8906204–: International symposium on heavy quark physics, Ithaca, NY (USA), 13-17 Jun 1989). Order Number DE90514614. Source: NTIS (US Sales Only), PC A02/MF A01.

NA14' is a charm photoproduction experiment, using a 100 GeV photon beam produced by the CERN SPS. Its set-up combines a high precision Silicium microvertex detector with a large acceptance spectrometer for both charged and neutral tracks. Search for D_S decays in the mode $D_S \rightarrow \eta'\ \pi$ and $D_S \rightarrow \phi\ \pi\ \pi^0$ are reported. A clear evidence is found for the former decay, with a preliminary branching ration $Br(D_S \rightarrow \eta'\ \pi)/Br(D_S \rightarrow \phi\ \pi) = 5 \pm 1.8 \pm 1.2$. An upper limit is given for the latter decay $Br(D_S \rightarrow \phi\ \pi\ \pi^0)/Br(\phi\ \pi) < 2.5$. Those 2 results are incompatible with theoretical expectations, where the first decay was supposed to be small and the second larger.

45798 (LAL–89-29) **Beauty physics at $e^+\ e^-$ colliders.** Wormser, G. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Sep 1989. 13p. (CONF-8905219–: Conference on CP violation in particle physics and astrophysics, Blois (France), 22-26 May 1989). Order Number DE90514615. Source: NTIS (US Sales Only), PC A03/MF A01.

Beauty physics to be performed in the next decade at the resonances Y(4S) and Z^0 are compared. Large similarities are found in the physics program and the reconstruction techniques of Z^0 and asymmetric Y(4S) colliders. The physics potential of the latter is found to be superior at equal luminosity to a symmetric machine, provided a large enough boost (≥ 5). Z^0 machines will probably be the main source of the rich B_S^0 physics during that period.

45799 (LA-UR–90-2631) **Intrinsic neutrino properties: As deduced from cosmology, astrophysics, accelerator and non-accelerator experiments.** Rosen, S.P. Los Alamos National Lab., NM (USA). 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-900367–2: 1. international symposium on particles, strings and cosmology, Boston, MA (USA), 27-31 Mar 1990). Order Number DE90016467. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

I review the intrinsic properties of neutrinos as deduced from cosmological, astrophysical, and laboratory experiments. Bounds on magnetic moments and theoretical models which yield large moments but small masses are briefly discussed. The MSW solution to the solar neutrino problem is reviewed in light of the existing data from the ^{37}Cl and Kamiokande II experiments. The combined data disfavor the adiabatic solution and tend to support either the large angle solution or the nonadiabatic one. In the former case the ^{71}Ga signal will be suppressed by the same factor as for ^{37}Cl, and in the latter case the suppression factor could be as large as 10 or more. 41 refs.

45800 (LA-UR–90-2776) **Transverse momentum distributions of hadrons.** Jacak, B. Los Alamos National Lab., NM (USA). [1990]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-900570–8: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90016493. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The study of hadron production in heavy ion collisions is essential to the search for effects beyond independent nucleon-nucleon collisions, for example the predicted phase transition to quark matter. Hadron distributions are known over a large range of transverse momenta for p-p collisions, so a careful study of the differences can be made. The transverse momentum distributions of hadrons may provide global information about p-nucleus and nucleus-nucleus collisions, such as the degree of thermalization achieved, and perhaps provide evidence for collective expansion of the highly excited central region. Comparison of the p_t and transverse mass, m_t, distributions of different hadronic species are crucial to extract this kind of information. Hadronic p_t spectra show effects of the collision dynamics, such as hard scattering processes, and possibly rescattering of partons as well as of the formed hadrons. Such modifications have been observed in p-nucleus collisions, and can be expected to be important in nucleus-nucleus reactions. The spectral shape changes arising in this manner cause a background in efforts to extract global information from hadronic p_t spectra. Lastly, there is an excess of pions observed at low p_t in p-A and A-A collisions. the origin of these soft pions is not yet well understood. The phenomenon represents a major difference between p-p and nuclear collisions. 31 refs., 8 figs.

45801 (LYCEN–89-02 S.10.1-S.10.6) **Inverse electroproduction at threshold: $\pi^- p \rightarrow \eta e^+\ e^-$ and Π^0 Dalitz decay: $\pi^0 \rightarrow \gamma e^+\ e^-$.** Fonvieille, H. (Clermont-Ferrand-2 Univ., 63 - Aubiere (FR). Lab. de Physique Corpusculaire); Bensayah, N.; Berthot, J.; Bertin, P.; Crouau, M.; Giffon, M.; Nahabetian, R.; Bihoreau, B.; Fournier, G.; Miller, J.; Saghai, B.; Samour, C.; Vernin, P. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

We present the results of an experiment studying the reactions: $\pi^- p \rightarrow \eta e^+\ e^-$ (1) and $\pi^0 \rightarrow \gamma e^+\ e^-$ (2) with high statistics. For process (1), in the range of low timelike transfers k^2, we give the measurement of the longitudinal multipole with a 5 to 10% accuracy, and the k^2 -dependence of the transverse multipole. Process (2) provides a direct measurement of the neutral pion electromagnetic transition form factor squared for several transfer values, and of its slope parameter a.

45802 (LYCEN–89-02 S.13.1-S.13.2) **Low energy π^+ electroproduction. First experimental testing.** Berthot, J. (Clermont-Ferrand-2 Univ., 63 - Aubiere (FR). Lab. de Physique Corpusculaire); Bertin, P.; Elouadrhiri, L.; Fonvieille, H.; Giffon, M.; Guichon, P.A.M.; Nahabetian, S.; Didelez, J.P.; Duval, M.A.; Frascaria, R.; Warde, E.; Bardin, G.; Botton, NLyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (In French). (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Short note. SACLAY LINAC/electroproduction; ELECTROPRODUCTION/pions plus; ELECTROPRODUCTION/cross sections; NUCLEONS/form factors; ELECTROPRODUCTION; NUCLEONS

45803 (LYCEN–89-02 S.2.1-S.2.5) **Medium effects in K^+-Nucleus scattering at intermediate energy.** Labarsouque, J. (Bordeaux-1 Univ., 33 - Gradignan (FR). Centre d'Etudes Nucleaires). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The K^+-nucleon effective interaction in nuclear matter is derived using the Brueckner theory from a K^+-nucleon potential built partly from the constituent quark model, partly in a phenomenological way. The influence of these conventional medium effects on the K^+-nucleus optical potential and on the elastic differential cross-section at 800 MeV/c is analyzed. Density dependent variations of the effective nucleon size (swelling) are also introduced. These less conventional medium effects lead to important modifications of

the K⁺-nucleus differential cross-section and improve significantly the agreement with the experimental data.

45804 (SLAC–360) **Properties of hadronic decays of the Z boson.** O'Shaughnessy, K.F. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1990. 115p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90014869. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The decays of the Z^0 boson to quarks and subsequently to hadrons were first directly observed in 1989 with the Mark II detector. This report studies the general properties of the hadronic events in the initial data sample recorded at center-of-mass energies near the Z^0 resonance (91.2 GeV). The preliminary chapters introduce the theoretical framework and the apparatus. A brief review is given of some features of Quantum Chromodynamics (QCD) that are relevant to the study. Two QCD-based models that are used to help correct the data distributions for detector effects and also for comparisons with the corrected distributions are described. For each of the detector systems used in the analysis, the design, operation and performance is discussed. The next chapter describes the event selection which is designed to provide a sample of well-measured hadronic events. The following three chapters contain the measured data distributions. The QCD-based models with parameters tuned at E_{cm} = 29 GeV describe the 91 GeV data distributions well. Each of these chapters also shows the variation of the observables as the center-of-mass energy changes. 43 figs., 12 tabs.

45805 (SLAC–367) **Searches for new quarks and leptons in Z boson decays.** Van Kooten, R.J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1990. 150p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90014870. Source: NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

Searches for the decay of Z bosons into pairs of new quarks and leptons in a data sample including 455 hadronic Z decays are presented. The Z bosons were produced in electon-positron annihilations at the SLAC Linear Collider operating in the center-of-mass energy range from 89.2 to 93.0 GeV. The Standard Model provides no prediction for fermion masses and does not exclude new generations of fermions. The existence and masses of these new particles may provide valuable information to help understand the pattern of fermion masses, and physics beyond the Standard Model. Specific searches for top quarks and sequential fourth generation charge–1/3(b′) quarks are made considering a variety of possible standard and non-standard decay modes. In addition, searches for sequential fourth generation massive neutrinos ν_4 and their charged lepton partners L^- are pursued. The ν_4 may be stable or decay through mixing to the lighter generations. The data sample is examined for new particle topologies of events with high-momentum isolated tracks, high-energy isolated photons, spherical event shapes, and detached vertices. No evidence is observed for the production of new quarks and leptons. 95% confidence lower mass limits of 40.7 GeV/c^2 for the top quark and 42.0 GeV/c^2 for the b′-quark mass are obtained regardless of the branching fractions to the considered decay modes. A significant range of mixing matrix elements of ν_4 to other generation neutrinos for a ν_4 mass from 1 GeV/c^2 to 43 GeV/c^2 is excluded at 95% confidence level. Measurements of the upper limit of the invisible width of the Z exclude additional values of the ν_4 mass and mixing matrix elements, and also permit the exclusion of a region in the L^- mass versus ν_4 mass plane.

45806 Multiparticle production in *p*-nucleus and nucleus-nucleus collisions. Hoang, T.F. (1749 Oxford Street, Berkeley, California 94709 (USA)); Crawford, H.J. *Physical Review, D (Particles Fields) (USA),* 42(1): 45-53 (1 Jul 1990). DOE Contract AC03-76SF00098.

Kinematic properties of inclusive $p+A\rightarrow\pi^-$ and $A_1+A_2\rightarrow\pi^-$ at 200 GeV/nucleon are compared with $p+p\rightarrow\pi^-$ at 200 GeV/*c* using data of CERN SPS experiments. The partition temperature is found to be practically the same for all the reactions analyzed, suggesting an approximate scaling. The peak shift of pseudorapidity η distributions of these nuclear reactions with respect to the peak of $pp\rightarrow\pi^-$ follows a geometrical law: $\eta^*\cong(A_1^{1/3}-A_2^{1/3})/8$, independent of energy. The mean free path *l* characteristic of the energy loss suffered by the projectile fireball passing through the nuclear target is $l\cong6.21$ fm. Semiempirical formulas for $\langle n_-\rangle$ of $p+A$ and A_1+A_2 reactions are proposed and tested using available data.

45807 Search for a nearly degenerate lepton doublet (L^-,L^0). Riles, K. (Stanford Linear Accelerator Center, Stanford University, Stanford, CA (USA)); Perl, M.L.; Barklow, T.; Boyarski, A.; Burchat, P.R.; Burke, D.L.; Dorfan, J.M.; Feldman, G.J.; Gladney, L.; Hanson, G.; Hayes, K.; Hollebeek, R.J.; Innes, W.R.; Jaros *Physical Review, D (Particles Fields) (USA),* 42(1): 1-9 (1 Jul 1990). DOE Contract AC03-76SF00515.

We have searched for a heavy charged lepton with an associated neutrino of nearly the same mass in e^+e^- annihilation data taken with the Mark II detector at a center-of-mass energy of 29 GeV. In order to suppress contamination from conventional two-photon reactions, this analysis uses a novel, radiative-tagging technique. Requiring the presence of an isolated, energetic photon allows a search for lepton doublets with mass splittings smaller than that previously accessible to experiment. No evidence for such a new lepton doublet has been found, enabling limits to be placed on allowed mass combinations. Mass splittings as low as 250–400 MeV/c^2 are excluded for charged-lepton masses between 500 MeV/c^2 and 10 GeV/c^2.

45808 Radiative corrections to *W*,*Z* masses and constraints on new *Z* bosons. Barger, V. (Physics Department, University of Wisconsin, Madison, WI (USA)); Hewett, J.L.; Rizzo, T.G. *Physical Review, D (Particles Fields) (USA),* 42(1): 152-165 (1 Jul 1990). DOE Contract AC02-76ER00881.

We explore the implications of the recent *W*- and *Z*-boson-mass measurements at the SLAC Linear Collider, CERN LEP, and Fermilab Tevatron, and also the μ pair and total hadronic cross sections measured at KEK TRISTAN. A detailed comparison is made between the M_W and M_Z data and standard-model predictions including radiative corrections. These measurements also constrain extended electroweak gauge models. We place model-dependent upper bounds on the mass of a second neutral gauge boson from M_W and M_Z data, and set lower bounds on the Z' mass from direct production searches at the Collider Detector at Fermilab (CDF). We analyze the effects of Z-Z' mixing on the Z width, leptonic branching ratio, and peak cross section at e^+e^- colliders. We find that a second Z cannot account for the increase in total hadronic and decrease in μ-pair cross sections observed at KEK TRISTAN and simultaneously satisfy the CDF Z' search limits.

45809 Constraints on Higgs-boson masses in E_6 models from CERN LEP experiments. Barger, V. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706 (USA)); Whisnant, K. *Physical Review, D (Particles Fields) (USA),* 42(1): 138-151 (1 Jul 1990). DOE Contract AC02-76ER00881.

We examine how CERN LEP experimental limits on $Z\rightarrow hf\bar{f}$ and $Z\rightarrow hA$ decays constrain E_6 multi-Higgs-boson models. We show that the limits on standard and supersymmetric Higgs bosons are easily applied to a multi-Higgs-boson model if it acts like an effective two-doublet model at the *W*-*Z* mass scale. In the large-M_{Z2} limit of the alternative left-right E_6 model the lightest Higgs-scalar mass m_h must be above 20 GeV (assuming $m_h>2m_\mu$); also $\tan\beta=v_2/v_1$ less than 0.58 is excluded. In the minimal rank-5 E_6 model there are no absolute limits on individual parameters, although substantial regions of m_h, m_A, and $m_{H^\pm}$ versus $\tan\beta$ are excluded. We indicate the improvements in the Higgs-boson mass bounds that may be achieved with increased statistics.

45810 Measurement of the neutron lifetime by counting trapped protons. Byrne, J. (University of Sussex, Falmer, Brighton BN1 9QH (United Kingdom)); Dawber, P.G.; Spain, J.A.; Williams, A.P.; Dewey, M.S.; Gilliam, D.M.; Greene, G.L.; Lamaze, G.P.; Scott, R.D.; Pauwels, J.; Eykens, R. *Physical Review Letters (USA),* 65(3): 289-292 (16 Jul 1990). DOE Contract AI05-87ER40340.

The neutron lifetime τ_n has been measured by counting decay protons stored in a Penning trap whose magnetic axis coincided with a neutron-beam axis. The result of the measurement is $\tau_n=893.6\pm5.3$ s, which agrees well with the value predicted by

precise measurements of the β-decay asymmetry parameter *A* and the standard model.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 45697, 45790, 45792, 45799, 45806, 45808, 45847, 45852, 45854, 45878, 45879, 45880, 45884, 45885, 46000, 46001, 46040, 46186

45811 (DOE/ER/40380–2, pp. 51-79) **An introduction to the QCD quark model and hadron spectroscopy.** Frank, M. (Kent State Univ., OH (USA)); Kumar, A.; Wakely, A. Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

This article is the authors interpretation of Frank Close's lecture series at the 4th annual HUGS at CEBAF. An introduction to the quark model of hadrons leading to a discussion of hadron spectroscopy is presented. A discussion of a quark potential is motivated by the study of meson spectroscopy. Baryon spectroscopy and electromagnetic excitations of baryons are studied both to further understand hadronic structure and interactions and to determine whether any baryon resonances could be hybrid states. 4 refs., 10 figs., 4 tabs.

45812 (IC–90/67) **Comments on the models of a light ZKM neutrino with a large magnetic moment.** Stephanov, M.A. (AN SSSR, Moscow (USSR). Fizicheskij Inst.); Vysotsky, M.I. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 10p. Order Number DE90636271. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Three recently proposed models of ZKM neutrino with $\mu_\nu \approx 10^{-11} \mu_B$ and $\mu_\nu <$ or approx. 10 eV are discussed. We argue that a supersymmetric model of Babu and Mohapatra is inconsistent. We find additional symmetry in the model by Ecker et al. which really guarantees the smallness of m_ν. We note that the possibility for neutrino and new scalar masses to vary within a large interval exists in the framework of the Leurer and Marcus model. (author). 11 refs, 3 figs.

45813 (IC–90/74) **Astrophysical bounds on light scalar particle couplings with electron and nucleons.** Blinnikov, S.I. (Institute of Theoretical and Experimental Physics, Moscow (USSR)); Vysotsky, M.I. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 8p. Order Number DE90636310. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The white dwarf cooling rate is used to obtain the upper bounds for light scalar couplings with matter. For sufficiently large coupling constants the scalars are trapped in a white dwarf interior, but the heat conductivity of the Sun interior increases unappropriately. If one introduces additional fermions, strongly coupled with scalars, then a narrow domain of the coupling constant values $\lambda_{e,N} \approx 3.10^{-4}$ becomes allowed. (author). 5 refs, 6 figs.

45814 (IC–90/78) **Neutrino magnetic moment.** Vysotsky, M.I. International Centre for Theoretical Physics, Trieste (Italy). Mar 1990. 11p. Order Number DE90636272. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

I would like to discuss the problem of a neutrino magnetic moment which is of interest since it deals with the probable time anticorrelation of the solar ν flux with the Sun magnetic activity. (author). 19 refs, 2 figs, 1 tab.

45815 (IC–90/94) **Weak decays of heavy mesons taking into account confinement of light quarks.** Ivanov, M.A. (International Centre for Theoretical Physics, Trieste (Italy)); Khomutenko, O.E. International Centre for Theoretical Physics, Trieste (Italy). May 1990. 15p. Order Number DE90636273. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The generalization of the Quark Confinement Model (QCM) is suggested to study processes with heavy quarks. It is assumed that the confinement mechanism defines the interactions between the light quarks only and does not influence the behaviour of heavy quarks. The scheme is developed to calculate the matrix elements between the initial heavy meson and the possible final states. The leptonic decay constants and weak form factors of heavy mesons are calculated which are needed for determining the Cabibbo-Kabayashi-Maskawa matrix elements. (author). 26 refs, 5 figs, 4 tabs.

45816 (KEK–89-12, pp. 213-229) **Production of hyperon on nucleus and its polarization.** Arai, I. (Tsukuba Univ., Sakura, Ibaraki (Japan). Inst. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

A study is carried out to establish a method for counter experiment on the production of lambda hyperons at backward angles in high energy hadron-nucleus reaction. The backward production of lambda hyperons involves two characteristic features. In the first place, the lambda hyperon, which carries a strangeness, is a very interesting probe for investigating the inner structure of nucleus because it is considered as one kind of impurity in nucleus. It is expected to act like an impurity in solid. Especially, the lambada hyperon brings new information, i.e., polarization. In the second place, the backward production of particles is thought to be a very promising reaction to reveal possible existence of exotic nuclear matter in nucleus because of its requirement for anomalous kinematics. Experiments are made to measure the polarizations and differential cross sections at backward angles. Both the polarizations and the cross sections are reproduced well by calculations based on quark-parton models while calculations based on the superposition of elementary process incorporated with the Fermi motion could not reproduce the polarizations at all. (N.K.).

45817 (LYCEN–89-02 C.16.1-C.16.19) **Search for manifest left-right symmetry with beta-ray polarimetry.** Van Klinken, J. (Rijksuniversiteit Gronigen (NL). Kernfysisch Versneller Inst.); Wichers, V.A. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Manifest left-right symmetric electroweak theories interpret parity violation in nuclear β decay as a low-energy phenomenon by suppressing right-handed V+A currents below the mass of a hypothetical right-handed boson. We constrained the possible occurrence of V+A currents by earlier absolute measurements using Gamow-Teller and mixed ^{3}H transitions, and by recent comparative measurements using pure Fermi and Gamow-Teller transitions. The instruments were based on Mott and Bhabha scattering.

45818 (LYCEN–89-02 S.15.1-S.15.11) **Effect of swelling of nucleons in nuclei on proton scattering at intermediate energy.** Hintz, N.M. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Sethi, A.; Brown, G.E. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The large scalar and vector mean fields employed in Dirac phenomenology can be reconciled with those from Dirac IA2, calculations by assuming that in medium, the scalar and vector mean fields are enhanced by factors of $(m_N/m_N^* \rho)^2$. This enhancement relies on meson masses decreasing in medium with increasing density at about the same rate as the nucleon effective mass. The spin orbit interaction should increase at a somewhat faster rate. The density dependence of meson masses results in a transformation to an optical potential of increased strength but slightly decreased radius. This decrease in radius removes a long standing discrepancy between nuclear densities obtained from electron scattering and those needed to fit proton-nucleus scattering.

45819 (LYCEN–89-02 S.16.1-S.16.8) **What can be learned from a precise measurement of the deuteron $A(q^2)$ structure function.** Platchkov, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Haute Energie). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

New accurate measurements of the deuteron $A(q^2)$ structure function for momentum transfers between 1 and 18 fm^{-2} are reported. Data are compared to several representative theoretical predictions. The neutron electric form factor is inferred from the data and its model dependence is discussed.

45820 (UM-P–89/66) **Relating the long B lifetime to a very heavy top.** He Xiao-Gang (Melbourne Univ., Parkville (Australia). School of Physics); Hou Weishu. Melbourne Univ., Parkville (Australia). School of Physics. Jun 1989. 12p. (OZ–89/19;MPI-PAE/PTh–35/89). Order Number DE90636274. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The long B lifetime is related to the heaviness of the top quark by a particular mass-mixing ansatz. The u-type quark mass matrix is of the Fritzsch form, while for the d-type it is diagonal except in the d-s plane, which generates the Cabibbo rotation. An $m_t \approx >$ 200 GeV from $V_{cb} \approx <$ 0.006 is predicted. One gets maximal CP, and the relations $V_{ub}/V_{cb} = \sqrt{u/c}$, $V_{td}/V_{cb} = \sqrt{d/s}$ and $V_{ts} = V_{cb}$ are close to exact. An interesting Wolfenstein pattern emerges. The viability and implications of having such a heavy top (such as lower M_Z), and the possibility of a vanishing V_{ub} and its impact on CP violation is discussed. 17 refs.

45821 (UM-P–89/94) **Off-shell T-matrices from inverse scattering.** Von Geramb, H.V. (Hamburg Univ. (Germany, F.R.). Theoretische Kernphysik); Amos, K.A. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 16p. Order Number DE90636316. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Phys. Rev., C, Oct 1989.

Inverse scattering theory is used to determine local, energy independent, coordinate space nucleon-nucleon potentials. Inversions are made of phase shifts obtained by analyzes of data and from meson exchange theory, in particular the Paris and the Bonn parametrizations. Half off-shell T-matrices are generated to compare the exact meson theoretical results with those of inversion and it is found that phase equivalent interactions have essentially the same off-shell behaviour for any physically significant range of momenta. 8 refs., 8 figs.

45822 (UWThPh–1990-21) **Geometrical aspects of the non-leptonic weak interactions of mesons.** Ecker, G. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 9 May 1990. 9p. Order Number DE90636317. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The evidence for a possible geometrical understanding of the effective chiral Lagrangian for the $\Delta S = 1$ non-leptonic weak interactions of pseudoscalar mesons is discussed. Both phenomenological arguments and the structure of the one-loop functional suggest a weak deformation of the geometrical objects vielbein and connection on the chiral coset space. (Author) 12 refs., 1 tab.

45823 (UWThPh–1990-24) **Neutrino masses, magnetic moments, and horizontal symmetries.** Grimus, W.; Neufeld, H. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 28 Jun 1990. 18p. Order Number DE90636318. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We investigate the general structure of the neutrino mass and magnetic matrices in the presence of an unbroken horizontal symmetry. In particular, we study the compatibility of masslessness induced by such a symmetry and a non-zero magnetic moment. We show that in this case at least two of the charged leptons must have equal masses. Furthermore, we give a general definition of Dirac neutrinos and demonstrate that they are not necessarily associated with a lepton number. (Author) 15 refs.

45824 **Model-independent determination of *K*-matrix poles and residues in the $\Delta(1232)$ region from the multipole data for pion photoproduction.** Davidson, R.M. (Department of Physics, Rensselaer Polytechnic Institute, Troy, NY (USA)). *Physical Review, D (Particles Fields) (USA),* 42(1): 20-29 (1 Jul 1990).

Using only the analytic structure of the *K* matrix and the assumption that the Compton-scattering amplitude is small compared to strong and electrostrong amplitudes, we extract the pole position and the residues for the resonant multipoles, in a model-independent and background-free fashion, directly from the experimentally obtained multipole data base in the $\Delta(1232)$ region, posing a challenge for QCD-inspired hadron models.

45825 **Twist-4 contributions to the hadron structure functions.** Qiu, J. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439 (USA)). *Physical Review, D (Particles Fields) (USA),* 42(1): 30-44 (1 Jul 1990). DOE Contract W-31109-ENG-38.

We present a new method for calculating the twist-4 contributions to the hadron structure functions. This new method leads to a clear space-time picture of twist-4 short-distance contributions and makes manifest the preservation of the underlying gauge invariance. The use of our new method results in a significant reduction in labor relative to past calculations of higher-twist contributions. In our new approach, the twist-4 short-distance contributions to the hadronic structure functions arise from the complete imaginary part of a photon-parton forward-scattering amplitude, and, hence, they can be given a simple parton-model interpretation. Possible tests of such twist-4 contributions are also discussed.

45826 **Extracting V_{bu}/V_{bc} from semileptonic *B* decays.** Kramer, G. (II. Institut fuer Theoretische Physik, der Universitaet Hamburg, D-2000 Hamburg 50 (West Germany)); Palmer, W.F. *Physical Review, D (Particles Fields) (USA),* 42(1): 85-95 (1 Jul 1990). DOE Contract AC02-76ER01545.

Recent CLEO and ARGUS results for charmless semileptonic decays of *B* mesons are compared to several models for exclusive channels under the assumption that the π, ρ, *D*, and D^* saturate the region of high electron momentum of interest in determining V_{bu}/V_{bc}. The effect of current-algebra-inspired $\pi\pi$ backgrounds and threshold constraints in the ρ channel, as well as the error made by the narrow-width approximation, are examined with a view to estimating the model dependence inherent in extracting V_{bu}/V_{bc} from the data. Total semileptonic rates to π and ρ differ widely, model to model, while rates to *D* and D^* final states have much less model dependence. Model dependence is somewhat smaller when only high lepton energies are concerned. V_{bc} calculated from exclusive semileptonic decay to *D* and D^* final states vary about 25% and 10%, respectively, model to model. The model dependence of V_{bu}/V_{bc} is also considerable. The narrow-width approximation in the ρ channel can be a 20% effect in the determination of this ratio because of the sensitivity of the high-energy region to the lowest mass of the final hadronic system. If current-algebra-inspired backgrounds are present, V_{bu}/V_{bc} may be considerably smaller than suggested by many models. If the D^{**} component of *b* to *c* is as large as recent CLEO data suggest, V_{bu}/V_{bc} may be 16% larger than expected by models that ignore this contribution.

45827 **Impact of new $|V_{ub}/V_{cb}|$ and ϵ'/ϵ measurements on weak mixing angles.** Kim, C.S. (Department of Physics, University of Durham, Durham (England)); Rosner, J.L.; Yuan, C. *Physical Review, D (Particles Fields) (USA),* 42(1): 96-111 (1 Jul 1990). DOE Contract AC02-80ER10587.

The value of the weak mixing parameter $|V_{ub}|$ has recently been determined to be of order $0.1|V_{cb}|$. A recent determination of ϵ'/ϵ in *CP*-violating kaon decays gives $(-0.5\pm1.5)\times10^{-3}$, in contrast to an earlier measurement of $(3.3\pm1.1)\times10^{-3}$. The implications of these results for the magnitudes and phases of the Kobayashi-Maskawa matrix elements and for the top-quark mass are explored.

45828 **Determination of the πNN coupling constant from elastic pion-nucleon scattering data.** Arndt, R.A. (Virginia Polytechnic Institute—State University, Blacksburg, VA (USA). Department of Physics); Li, Z.; Roper, L.D.; Workman, R.L. *Physical Review Letters (USA),* 65(2): 157-158 (9 Jul 1990). DOE Contract AS05-76ER04928.

We have analyzed the available pion-nucleon elastic scattering data with laboratory kinetic energy below 2 GeV and have extracted the charged-pion–nucleon coupling constant. The extracted value of f^2, using fixed-t dispersion relations, is found to be 0.0735 ± 0.0015, a value in conflict with the result of Koch and Pietarinen, yet consistent with the value of the $\pi^0 pp$ coupling determined in the recent Nijmegen analysis of pp scattering data.

45829 Resonances in the Higgs sector for large, finite Higgs-boson mass. Rosenfeld, R. (Enrico Fermi Institute, University of Chicago, Chicago, IL (USA)). *Physical Review, D (Particles Fields) (USA)*, 42(1): 126-137 (1 Jul 1990). DOE Contract AC02-80ER10587.

We study the Higgs sector of the standard model for a large but finite Higgs-boson mass. We unitarize the scattering amplitudes for longitudinal gauge bosons using a prescription given by Brown and Goble that introduces scalar and vector resonances. The masses of these resonances are analyzed as a function of the Higgs-boson mass and their effects in proton-proton colliders are discussed.

45830 Some signatures of right-handed W bosons in hadron colliders. Rosner, J.L. (Enrico Fermi Institute, University of Chicago, Chicago, IL (USA)); Takasugi, E. *Physical Review, D (Particles Fields) (USA)*, 42(1): 241-244 (1 Jul 1990). DOE Contract AC02-80ER10587.

Several signatures for right-handed W (W_R) production in collider experiments are noted. If the right-handed neutrino N is too heavy to permit the decay $W_R \rightarrow eN$, the decay $W_R \rightarrow t+(d, s, \text{or } b)$ may still be allowed. Given present limits on the top-quark mass, it is then likely that t will decay 100% of the time to $W+b$. We thus urge that the signature $W+2$ jets be examined for clusters of events consistent with $M(W+\text{jet}_1+\text{jet}_2)=M_{WR}$, $M(W+\text{jet}_2)=m_t$. Some decay modes involving the right-handed neutrino are also mentioned briefly.

45831 Poles of the πN P_{11} partial-wave amplitude. Cutkosky, R.E. (Physics Department, Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213 (USA)); Wang, S. *Physical Review, D (Particles Fields) (USA)*, 42(1): 235-237 (1 Jul 1990). DOE Contract AC02-76ER03066.

We have carried out fits to the energy dependence of the P_{11} partial-wave amplitude as obtained in two different single-energy analyses of π-N scattering data. Data on inelastic cross sections were also used. The fits used an analytic approximation to the coupled-channel amplitudes suggested by the Dyson equations. From each set of partial-wave data, two resonances were obtained, at roughly 1470 and 1700 MeV. Each of these resonances is associated with a cluster of poles on the Riemann surface.

45832 Gluon color-electric dipole moment and its anomalous dimension. Braaten, E. (Northwestern University, Evanston, Illinois 60208 (USA). Department of Physics and Astronomy); Li, C.S.; Yuan, T.C. *Physical Review, D (Particles Fields) (USA)*, 42(1): 276-278 (1 Jul 1990). DOE Contract AC02-76ER02289.

The purely gluonic dimension-6 CP-violating operator recently discovered by Weinberg is identified as a color-electric dipole moment for the gluon. It can be represented in a manifestly Bose-symmetric form using Dirac algebra. This simplifies the calculation of its anomalous dimension to first order in the QCD coupling constant.

45833 On the existence of bound states for a massive spin-one particle and a magnetic monopole. Olsen, H.A. (Institute of Physics, University of Trondheim, AVH, N-7055 Dragvoll, Norway (NO)); Osland, P.; Wu, T.T. *Physical Review, D (Particles Fields) (USA)*, 42(2): 665-689 (15 Jul 1990). DOE Contract FG02-84ER40158.

We analyze the interaction of a magnetic monopole with a massive spin-one particle. The necessary angular momentum algebra, involving vector monopole harmonics, is developed. Physically acceptable states must lead to Hamiltonians whose differences are integrable. While an extra magnetic moment can lead to attraction at large distances, no value of the magnetic moment leads simultaneously to a physically acceptable behavior of the wave function at the origin. For no value of the magnetic moment do bound states exist, unless an additional short-range interaction is introduced.

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 45735, 45820, 45829, 45830, 45832, 45877, 45884, 45887

45834 (DOE/ER/40380–2, pp. 1-50) **Breaking and restoration of chiral symmetry.** Brown, G.E. (State Univ. of New York, Stony Brook (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

Chiral symmetry is a symmetry under combined γ_5 and flavor transformations. Although the Yang-Mills equations were invented in 1954, chiral symmetry was first introduced in 1960 into the physics of nucleons and mesons, which the author shall describe as physics in the Nambu-Goldstone, or broken symmetry mode. Chiral symmetry is a strict symmetry underlying the Yang-Mills equation in the limit of zero bare (current) quark mass. In these lectures, the author shall consider only this limit, later talking a bit about explicit chiral symmetry breaking which is introduced by giving the quarks bare masses. 34 refs., 9 figs.

45835 (KEK–89-22, pp. 1-13) **Conservation laws in a perturbed k = 1 SU(2) Wess-Zumino-Witten model.** Kobayashi, Ken-ichiro (Harvard Univ., Cambridge, MA (USA). Lyman Lab. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We study conservation laws in the SU(2) Wess-Zumino-Witten (WZW) model with the level k = 1 perturbed by a certain relevant operator. The perturbed system is a special case of the sine-Gordon theory to the lowest order in the perturbation theory, and it turns out that there exist extra conserved currents due to the SU(2) symmetry in the original WZW model. (author).

45836 (KEK–89-22, pp. 45-76) **Link polynomials, linking number and exactly solvable models.** Deguchi, Tetsuo (Tokyo Univ. (Japan). Coll. of General Education). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

Through a general method we construct link polynomials from exactly solvable models in statistical mechanics. Various examples are explicitly shown. From the crossing symmetry we derive link polynomials with the graphical calculation. By use of transformations we obtain different link polynomials from a solvable model. (author) 67 refs.

45837 (KEK–89-22, pp. 77-85) **Exact solution of the fully anisotropic Kondo problem.** Quano, Yas-hiro (Tokyo Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

It is shown that the fully anisotropic one-dimensional Kondo problem is completely integrable based on the equivalence with the inhomogeneous eight vertex model. (author).

45838 (KEK–89-22, pp. 143-151) **N=2 superconformal symmetry based on N=1 supersymmetric non-compact group current algebra.** Nojiri, Shin-ichi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

N=1 supersymmetric SO(2,1)/U(1) coset model is analyzed. We show that this model contains unitary representations under some conditions. Furthermore, it is shown that this algebra is equivalent to Dixon, Peskin and Lykken's N=2 superconformal algebra (c>3) which was obtained from non-supersymmetric SO(2,1) current algebra. (author).

45839 (KEK–89-22, pp. 153-164) **Spontaneous deformation of maximally symmetric Calabi-Yau manifolds and a realistic four-generation model.** Matsuoka, Takeo (Nagoya Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'*. Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We propose the spontaneous deformation of a conformally invariant Calabi-Yau manifold with a maximal discrete symmetry. This spontaneous deformation is triggered by the soft supersymmetry breaking. A realistic four-generation superstring model is derived on the basis of this mechanism. In this superstring model, large masses of leptoquark chiral superfields g and g-bar are induced by the existence of the large intermediate energy scale M_I = $10^{15\approx16}$GeV. This result guarantees the longevity of protons. Furthermore, only one family among six families of Higgs sector (h and h') remains massless at energies below the scale M_I. (author).

45840 (KEK–89-22, pp. 165-177) **Torus-orbifold equivalence in compactified string theories.** Sakamoto, Makoto (Kobe Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'*. Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

It is shown that any compactified closed string theory on an abelian orbifold is equivalent to that on a torus if the rank of the gauge symmetry of strings on the orbifold is equal to the dimension of the orbifold. Our proof clarifies the correspondence of operators as well as states between two theories. (author).

45841 (KEK–89-22, pp. 207-218) **Renormalization invariant effective action of the σ-model string theory.** Cheng, Y.X. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'*. Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

Before a complete formulation of string will be found we have to use indirect methods to construct the effective action for string theory with current string technology. One approach is based on the calculation of S-matrix elements. An other possibility is to use the β-function of the nonlinear σ-model. An important clue in latter approach is to explain the conditions of conformal invariance of the two dimensional quantum field theory describing string propagating in the background fields ϕ^m, i.e. $\beta^m(\phi)$=0, as the the classical string equation of motion. In lower order of α' there is a well known relation between S_{eff} and β-functions of graviton and dilaton. Considerable endeavors have been devoted to solve the conjecture that this formulation may be hold to all order in α'-expansions as a fundamental one of effective action. In present note we shall discuss how to realize this conjecture. We discussed Tseytlin's ansatz in direct calculation and found that this approach gives an unified picture to obtain a consistent spacetime effective action for string, specially in loop level. We show obviously that the consistent subtraction of the moebius logarithmic infinity from multiple poles arises from the requirement of the renormalizability of string theory. (author).

45842 (KEK–89-22, pp. 219-228) **Symmetry of cutoff theory and symmetry of string theory.** Sakai, Kenji (Osaka Univ., Toyonaka (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'*. Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We relate a classical symmetry to that of the corresponding cutoff theory, which is an extension of Wilson's renormalization group equation. The nilpotent BRST symmetry of the string theory can generate the string field equation with a gauge symmetry. When this gauge symmetry is fixed, the equation turns to be equivalent to the condition of the Weyl invariance. (author).

45843 (KEK–89-22, pp. 293-304) **Super Wess-Zumino-Witten models from super Chern-Simons theories.** Sakai, Norisuke (Tokyo Inst. of Tech. (Japan). Dept. of Physics); Tanii, Yoshiaki. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'*. Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

The two-dimensional super Wess-Zumino-Witten models are obtained from the super Chern-Simons theories for a three-dimensional manifold with a topology of a disk x R. By appropriately choosing total derivative terms in the three-dimensional action, the N = 1/2 supersymmetry can be maintained on the boundary. The N = 1 supersymmetry on the boundary can be realized by choosing particular values for parameters of the total derivative terms. (author).

45844 (LBL–29136) **On null tests of time-reversal invariance.** Conzett, H.E. Lawrence Berkeley Lab., CA (USA). May 1990. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900726–2: International conference on polarization phenomena in nuclear physics, Paris (France), 9-13 Jul 1990). Order Number DE90015722. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Short communication. T INVARIANCE/testing; TESTING

45845 (RCNP-P–108, pp. 83-87) **Collective rotational Hamiltonian from a microscopic viewpoint.** Une, Tsutomu (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. ROTATIONAL STATES/ collective model; ROTATIONAL STATES/hamiltonians; HAMILTONIANS; MOMENT OF INERTIA; T INVARIANCE; GENERATOR-COORDINATE METHOD; CRANKING MODEL; WAVE FUNCTIONS

45846 (UM-P–89/39) **Charged neutrinos?.** Foot, R.; Joshi, G.C.; Lew, H.; Volkas, R.R. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 11p. (OZ–89/11). Order Number DE90635724. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

If right-handed neutrinos are added to the Standard Model (SM), then the charge assignments of the quarks and leptons are not fixed by anomaly cancellation, but depend on a free continuous parameter. Thus if right-handed neutrinos exist then it is possible that there also exist small deviations from the canonical assignments of the electric charge, leading to charged neutrinos and neutrons. Experiment is used to limit this parameter. It is pointed out that a nearly massless neutrino with a small charge may nonetheless have large tree-level and anomalous magnetic moments. Ways that the SM might be extended to yield charged neutrinos are indicated. 7 refs.

45847 (UM-P–89/77) **The exact analytical form for the box diagram with one heavy external quark.** He Xiao-Gang; McKellar, B.H.J.; Pallaghy, P.K. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 18p. (OZ–89/24). Order Number DE90635725. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The exact analytical form for the box-diagram amplitude with one non-vanishing external quark mass is presented. The consequences of this work for meson mixing and the CP violating charge

asymmetry are investigated in heavy quark systems. In the T^0 - T^{-0} system with the three generation model the charge asymmetry is typically of order ($\approx 10^{-4}$) but the mixing is extremely small ($<10^{-18}$). In the four generation case, the mixing can be greatly enhanced. With a normal KM matrix, the mixing is still very small ($< 10^{-10}$) but with a flavour-flipped KM matrix, the mixing can be as large as a few percent while the charge asymmetry is still small ($<10^{-4}$). In the B'^0 - $B^{-'0}$ system, the mixing and charge asymmetry can be of order a few percent whereas in the T'^0 - $T^{-'0}$ system, the mixing is small. 13 refs., 4 figs.

45848 (UM-P–89/82) **Charge quantization in supersymmetric, technicolor, and composite models.** He, Xiao-Gang; Joshi, G.C.; McKellar, B.H.J.; Volkas, R.R. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 14p. (OZ-P–89/27). Order Number DE90635726. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The possibility of quantizing the electric charge in supersymmetric, technicolor, and composite models is examined by studying some specific examples. By requiring an anomaly free theory, the appropriate symmetry breaking pattern of the gauge group, and mass generation, the electric charges may be determined. 15 refs.

6454 Field Theory

Refer also to citation(s) 45829, 46104

45849 (DOE/ER/40380–2, pp. 186-196) **Effective action in path integral approach for a scalar field theory.** Lim, K. (Indiana Univ., Bloomington (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The basic object of the path integral approach in field theory is the generating functional Z for the Green's function. The generating functional W[J] of the connected Green's function is the logarithm of Z. The effective action is the Legrende transform of W[J]. Its importance is twofold. First it is the generating functional of the one-particle irreducible Green's function. Second it gives an effective potential of the fields which contains quantum corrections. In this note, the author studies the formalism of the effective action. For simplicity his discussion is based on the treatment of scalar self-interacting field ϕ. In section 2 he presents the general formalism of effective action and loop-expansion. Section 3 is a sample calculation for a scalar field with renormalizable self-interaction. 6 refs.

45850 (DOE/ER/40380–2, pp. 212-226) **Large N_c expansion, from QCD to skyrme.** Wong, E.C. (Univ. of Pennsylvania, Philadelphia (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

In the context of the path integral, with both qualitative and mathematical manipulations, it is possible to derive a Skyrme-like lagrangian from a simplified QCD Lagrangian. One awkward assumption which has to be made and justified is the large N_c expansion, where N_c is the number of colors. This paper is by no means original, but it is hoped to be pedagogical. 6 refs.

45851 (IC–90/69) **Quantum gravity in the chronometrically invariant formalism of Zel'manov.** Pollock, M.D. International Centre for Theoretical Physics, Trieste (Italy). Mar 1990. 11p. Order Number DE90635690. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Einstein-Hilbert lagrangian function R is expressed in terms of the chronometrically invariant quantities introduced by Zel'manov, for an arbitrary four-dimensional metric g_{ij}. The chronometrically invariant three-space is the physical space $\gamma_{\alpha\beta}=g_{\alpha\beta}-g0_\alpha g0_\beta/g00$, whose determinant is γ. The momentum canonically conjugate to $\gamma_{\alpha\beta}$ is $\pi^{\alpha\beta}=-\sqrt{\gamma}(K^{\alpha\beta}-\gamma^{\alpha\beta}K)$, where $K_{\alpha\beta}=1/2\delta_t\gamma_{\alpha\beta}$ and $\delta_t=$—g00— $^{-1/2}\delta_0$ is the chronometrically invariant derivative with respect to time. The Wheeler-DeWitt equation for the wave function Ψ is derived. For a stationary space-time, such as the Kerr metric, $\pi^{\alpha\beta}$ vanishes, implying that there is then no dynamics, as expected. The formalism coincides with that of Arnowitt, Deser and Misner when the space-time cross-terms $g0_\alpha$ are absent. (author). 11 refs.

45852 (IC–90/71) **Strong coupling expansion in lattice QCD at finite temperature and finite baryon density.** Azakov, S.I. (International Centre for Theoretical Physics, Trieste (Italy)); Aliev, E.S. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 25p. Order Number DE90635691. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Using strong coupling expansion in lattice QCD we study analytically the restoration of chiral symmetry in the theory with finite temperature and finite baryon number density and make predictions regarding the order of the phase transition. The inclusion of baryons does not change the phase picture when $\mu=0$, and in full QCD (with mesons and baryons) there is a chiral phase transition of the second order, discovered earlier in QCD without baryons. We have found a first order chiral phase transition at $\mu=\mu_c$ and at any low temperature. (author). 19 refs, 3 figs.

45853 (IC–90/81) **Quasiparadoxes of massless QED.** Smilga, A.V. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 26p. Order Number DE90635692. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We show that the limit $m_e=0$ in the conventional QED is not smooth. In contrast to the massless QED the massive QED, however small the mass is, involves finite probability chirality breaking processes. The chirality breaking effects may be observed provided the size of experimental installation is greater than the formation length $\approx E/m^2$. We discuss also the finite cross sections of virtual longitudinal photon production and scattering in massless QED recently found by Gorsky, Ioffe and Khodjamirian and argue that real longitudinal photons do not interact while the limit of zero virtuality is not smooth. (author). 23 refs, 4 figs.

45854 (IC–90/90) **Spinor connections and geometrization of fermion.** Liu Yufen. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 7p. Order Number DE90635693. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The basic principles of spinor gauge theories are presented. Spinor connections and their physical interpretations are studied in detail. The geometrization of right (or left)-handed fermions in higher dimensional space is discussed. (author). 4 refs.

45855 (INS–812) **Quantum distribution function of nonequilibrium system.** Sogo, Kiyoshi; Fujimoto, Yasushi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 15p. Order Number DE90513765. Source: NTIS (US Sales Only), PC A03/MF A01.

A path integral representation is derived for the Wigner distribution function of a nonequilibrium system coupled with heat bath. Under appropriate conditions, the Wigner distribution function approaches an equilibrium distribution, which manifests shifting and broadening of spectral lines due to the interaction with heat bath. It is shown that the equilibrium distribution becomes the quantum canonical distribution in the vanishing coupling constant limit. (author).

45856 (INS–814) **Eigenvalue statistics of distorted random matrices.** Cheon, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 12p. Order Number DE90513782. Source: NTIS (US Sales Only), PC A03/MF A01.

Numerical study of a set of random matrices which interpolate Poisson and Gaussian orthogonal ensembles is reported. The result indicates that the transition from Poisson to Wigner distribution for the nearest level spacing does not depend on the detail of the random matrix parametrization and is essentially governed by a single parameter. Brody's one-parameter interpolation formula is found to describe the transition rather well. (author).

45857 (KEK–89-22, pp. 15-24) **On the integrals of motion away from criticality.** Kodaira, J. (Hiroshima Univ. (Japan). Dept. of Physics); Sasai, Y.; Sato, H. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We discuss higher order corrections in the integrals of motion for the unitary minimal model with the central charge $c = 1 - 6/p(p + 1)$ perturbed by the (1,3) operator. After clarifying their origin, we give an explicit expression in the case of $p = 5$ for the spin 4 current. (author).

45858 (KEK–89-22, pp. 27-34) **Algebraic aspects of the deformation of conformal field theory.** Fukuma, Masafumi (Tokyo Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We point out that the Toda lattice hierarchy known in soliton theory is relevant for the description of the deformation of rational conformal field theories while the KP hierarchy describes unperturbed conformal field theories. In particular, the holomorphic parts of the conserved currents in the perturbed system (the Toda lattice hierarchy) coincide with the conserved currents in the KP hierarchy and can be written in terms of the W-algebraic currents. Furthermore, their anti-holomorphic counterparts are obtained. These results assure the conjecture that Toda field theory associated with an affine Lie algebra g describes the system perturbed from g coset conformal model. (author).

45859 (KEK–89-22, pp. 35-44) **On q-analog Racah-Wigner algebra, Yang-Baxter relations and Witten's quadratic relations.** Nomura, Masao (Tokyo Univ. (Japan). Coll. of General Education). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

Racah-Wigner (R-W) algebra of quantum group $SU_q(2)$ is summarized in connection with Yang-Baxter (Y-B) relations. Two sets of quadratic relations in operators, one given by Woronowicz and the other by Witten, are linked to relations for $SU_q(2)$ generators and are used to formulate a q-analog Wigner-Eckart theorem. (author).

45860 (KEK–89-22, pp. 87-108) **Comments on super Schwarzian derivatives.** Matsuda, Satoshi (Kyoto Univ. (Japan). School of Liberal Arts and Sciences). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We propose and discuss a powerful method to obtain systematically the generic forms of super Schwarzian derivatives for various cases of higher N superconformal algebras. (author).

45861 (KEK–89-22, pp. 123-132) **Parafermios as Z_N orbifold and level 3 SU(3) Kac-Moody algebra.** Fujitsu, Akira (Kobe Univ. (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We study quantum field theory of bosons on torus and orbifold. When torus is in special moduli, representations of the theory are equivalent to those of some rational conformal field theories. We show that there are parafermionic current algebra in Z_N orbifold models. (author).

45862 (KEK–89-22, pp. 109-121) **Lie algebra cohomology and N = 2 superconformal field theory.** Hosono, Shinobu (Nagoya Univ. (Japan). Dept. of Physics); Tsuchiya, Akihiro. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We study a cohomological structure of the N = 2 superconformal field theories constructed by Kazama and Suzuki. We note that the N = 2 superconformal field theory can be formulated precisely as the affinization of the Lie algebra cohomology theory for the classical Lie algebras by Kostant. A general theory for writing down the Poincare polynomial for the chiral ring is also presented. (author).

45863 (KEK–89-22, pp. 133-142) **C=3d algebra.** Odake, Satoru (Tokyo Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We define a superconformal algebra with the central charge c = 3d, which is the symmetry of the non-linear σ model on a complex d dimensional Calabi-Yau manifold. The c = 3d algebra is an extended superconformal algebra obtained by adding the spectral flow generators to the N = 2 superconformal algebra. We study the representation theory and show that its representations are invariant under the integer-shift spectral flow. We present the character formulas and their modular transformation properties. We also discuss the relation to the N = 4 superconformal algebra. (author).

45864 (KEK–89-22, pp. 229-240) **Canonical quantization Witten's string field theory in mid-point time formalism.** Maeno, Masahiro (Osaka Univ., Toyonaka (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We carry out canonical quantization of Witten's string field theory in mid-point time formalism. A divergence which arises in kinetic term can be regularized by discretizing the string. The equal time commutation relation of string fields can be calculated in this manner, and the theory is shown to coincide with the one which is expected in a formal Lagrangean path integral quantization. (author).

45865 (KEK–89-22, pp. 241-251) **Non-polynomial closed string field theory.** Suehiro, Kazuhiko (Kyoto Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

A non-polynomial closed string field theory is presented in a complete form, in the framework recently proposed by Saadi and Zwiebach. All the string interaction vertices possessing string overlapping patterns of polyhedra are specified by very simple conditions. It is shown that the Feynman diagrams with these vertices correctly cover the whole moduli space at the tree level. (author).

45866 (KEK–89-22, pp. 283-291) **BRST quantization of Chern-Simons gauge theory.** Imai, Hiroshi (Niigata Univ. (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We quantize non-abelian gauge theory with only a Chern-Simons term in three dimensions by using the generalized Hamiltonian formalism of Batalin and Fradkin for irreducible first- and second-class constrained systems, and derive a covariant action for the

theory which is invariant under the off-shell nilpotent BRST transformation. (author).

45867 (KEK–89-22, pp. 331-340) **Path-integral quantization of a particle coupled with Chern-Simons gauge field.** Itoi, Chigaku (Nihon Univ., Tokyo (Japan). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

The transmutation of a charged scalar particle into a spinning particle is studied. We evaluate the partition function of the particles in three dimensions coupled with Chern-Simons gauge field. The regularization scheme is discussed in detail. It is shown that the Polyakov claim is justified. (author).

45868 (KEK–89-22, pp. 351-375) **Nonlinear sigma model and quantum antiferromagnets.** Yamamoto, Hisashi (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

It is broadly viewed that the magnetism may play an important role in the high-T_c superconductivity in the lamellar CuO_2 materials. In this paper, based on the one-loop analysis of the CP^1 (or S^2) nonlinear σ model as a low energy effective field theory of the Hubbard or the antiferromagnetic Heisenberg model, some magnetic properties of d-(space) dimensional quantum antiferromagnets are studied. For $d \leq 1$, or $d \leq 2$ at any nonzero temperature, long range Neel order (LRNO) disappears, in agreement with Mermin-Wagner-Coleman's theorem. For d = 3 in the weak coupling region, LRNO exists below the critical temperature T_N(Neel temperature). T_N decreases as the ratio (= α) of interlayer coupling over that within Cu - O layers becomes small. For the realistic case ($\alpha \simeq 10^{-5}$) the phase diagram and the behavior of magnetization and the spin correlation length as functions of temperature are investigated in detail. The results show that our anisotropic field theory model could give a reasonably well description of the magnetic properties indicated by some experiments on La_2CuO_4. (author).

45869 (KEK–89-22, pp. 383-391) **Necessity of finite size term in WZW model: Coherent-state path integral approach.** Iso, Satoshi (Tokyo Univ. (Japan). Dept. of Physics); Itoi, Chigaku; Mukaida, Hisamitsu. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

By using a coherent state path integral method, we construct an action which reproduces the Kac-Moody algebra of level k. We show that it is the light cone WZW action with a finite size correction term. The current operators also contain a finite size correction term and are shown to satisfy the original commutation relations. The finite term is necessary to derive the exact phase space and also to understand the constraint $0 \leq 2J \leq k$ (for SU(2)) in terms of the path integral language. (author).

45870 (LA-UR–90-2861) **Tests of the weak equivalence principle for antiprotons and positrons from particle-antiparticle frequency comparisons.** Hughes, R.J. Los Alamos National Lab., NM (USA). 1990. 3p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-900777–1: Workshop on science at the KAON factory, Vancouver (Canada), 23-28 Jul 1990). Order Number DE90016444. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Short communication. ANTIPROTONS/equivalence principle; POSITRONS/equivalence principle; ANTIPROTONS; POSITRONS; CYCLOTRON FREQUENCY; TESTING; GRAVITATIONAL FIELDS

45871 (NBI-HE–90-19) **External field dependence in SU(2) lattice theory.** Ambjoern, J. (Niels Bohr Inst., Copenhagen (Denmark)); Mitrjushkin, V.K.; Zadorozhny, A.M. Niels Bohr Inst., Copenhagen (Denmark). Apr 1990. 13p. Order Number DE90635694. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We study SU(2) gauge theory in the presence of a constant chromomagnetic background field. For large fields we observe qualitative agreement with the one-loop perturbative expression for the energy density. (orig.).

45872 (NBI-HE–90-21) **Regularization of the one-matrix models.** Jurkiewicz, J. Niels Bohr Inst., Copenhagen (Denmark). Apr 1990. 13p. Order Number DE90635695. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We analyze the critical properties of the one-matrix model near its critical point, corresponding to the continuum limit. We consider the model with quartic and six-order interactions. This last can be viewed as a regularization of the model. We show that the regularized theory develops a phase structure in which it is impossible to reach the standard continuum limit. (orig.).

45873 (PB–90-873977/XAB) **Superstring theories and models: Cosmological implications. January 1985-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1985-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 51p. Source: NTISPC N01/MF N01.

This bibliography contains citations concerning the use of superstrings in studies of such relativistic phenomena as space-time extension and supergravity. Primordial magnetic monopoles, local cosmic strings, and studies of preon models are among the topics discussed. Calbi-Yau manifolds, and supersymmetrical Kaluza-Klein theories are also considered. Citations relating specifically to particle studies are included in a separate bibliography. (Contains 80 citations fully indexed and including a title list.)

45874 (RRK–90-2) **Gravitational field of static and thick domain walls.** Tomita, Kenji. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Feb 1990. 7p. Order Number DE90513706. Source: NTIS (US Sales Only), PC A02/MF A01.

The behavior of static and thick domain walls with a scalar field is studied. If in both sides of a domain wall there are asymptotically vacuum regions, their regions can be expressed by the static Kasner solutions and the relation between the Kasner parameters in both sides is the same as that in the case of thin domain Walls. An analytic solution is shown as the example. (author).

45875 (SLAC–351) **Discretized light-cone quantization: Application to quantum electrodynamics.** Tang, A.C. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1990. 225p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90014832. Source: NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.

In this work, a general method for solving quantum field theories, Discretized Light-Cone Quantization (DLCQ), is presented. The method is very straightforward and essentially consists of diagonalizing the light-cone Hamiltonian matrix for the mass spectrum and wavefunctions. This method has been applied successfully in the past to various one space, one time dimensional theories. In each of these past applications, the mass spectrum and wave functions were successfully obtained, and all results agree with previous analytical and numerical work. The success of DLCQ in 1 + 1 dimensions provides the hope of solving theories in three space and one time dimensions. The application to higher dimensions is much more involved than in 1 + 1 dimensions due to the need to introduce ultraviolet and infrared regulators, and invoke a renormalization scheme consistent with gauge invariance and Lorentz invariance. This is in addition to the extra work involved implementing two extra dimensions with their added degrees of freedom. In this paper, I will present the application of DLCQ to 3 + 1 dimensional Quantum Electrodynamics. 24 refs., 43 figs., 2 tabs.

45876 (SLAC-PUB–5218) **Discrete gravity.** Noyes, H.P. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jul 1990.

21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9009227–1: 2. Physical interpretations of relativity theory, London (UK), 3-8 Sep 1990). Order Number DE90014808. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following: constructing a bit-string universe; quantized space-time; combinatorial hierarchy labels; gravitational stabilization of the proton; quantum geons; cosmological consequences; the proton-electron mass ratio, weak-electromagnetic unification; and sewgut. (LSP)

45877 (UM-P–88/111(rev.)) **The critical dimensions of parastrings from the covariant formalism.** Belyea, C.I.; Warner, R.C. Melbourne Univ., Parkville (Australia). School of Physics. Oct 1989. 12p. (OZ–88/15). Order Number DE90635696. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The critical dimensions of first-quantized parastrings by the covariant method is presented. An apparent disagreement with previous light-cone results of Mansouri and coworkers was found. A possible interpretation of the discrepancy is offered. 11 refs.

45878 (UM-P–89/52) **Kaon B parameter with static cavity QCD corrections.** Hollenberg, L.C.L.; McKellar, B.H.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 38p. (OZ–89/16). Order Number DE90635698. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The kaon B parameters is computed in a framework in which static cavity QCD loop corrections to the weak interactions of hadrons are included by extending the Fock state wavefunction to include O(g) bremsstrahlung and vacuum fluctuation states. Since the QCD corrections are inherent in the calculation of the matrix elements of the bare effective weak $\Delta S=2$ Hamiltonian between hadronic states the scale matching problem of the standard short distance analysis is alleviated. The modified static cavity model used is characterised by four parameters; the effective quark-gluon coupling constant, the confinement pressure, the zero-point energy and a parameter governing the centre-of-mass corrections. These parameters are fitted to the π and ρ masses and the charge radii of π and K. Results are given for the ultra-relativistic ($m_u=m_d=0$) sector and for a region ($m_u=m_d\simeq$ 140 MeV) where the $\Delta I=1/2$ rule is uniquely reproduced. For the parameter set which describes the $\Delta I=1/2$ rule, $B_K=0.58$ at a basis size of $N_B=6$ was found. 10 refs., 12 figs., 3 tabs.

45879 (UM-P–89/53) **Static cavity calculation of heavy meson neutral mixing with QCD corrections.** Hollenberg, L.C.L.; McKellar, B.H.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 9p. (OZ–89/17). Order Number DE90635699. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The neutral mixing matrix elements describing D deg and B deg mixing are calculated in a static cavity model previously fitted to the $\Delta I=1/2$ rule of kaon decay. Since the model is based on O(g) wavefunctions, computation of hadronic matrix elements includes $O(g^2)$ corrections. Specifically, the quantities $f_D\sqrt{B_D}$ and $F_B\sqrt{B_B}$ were computed for basis sizes $N_B=1,2,3$ and 6. At $N_B=6$, the values $F_D\sqrt{B_D}$ =90 MeV and $F_B\sqrt{B_B}$=62 MeV. The ratio of these quantities agrees well with non-relativistic expectations. 8 refs., 2 figs.

45880 (UM-P–89/60) **Polarisation of the magnetised scalar and spinor vacua.** Witte, N.S. Melbourne Univ., Parkville (Australia). School of Physics. [1989]. 76p. Order Number DE90635700. Source: NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS.

The vacuum polarization tensor of the magnetised boson system is derived within the random phase or one loop approximation and presented, along with the fermion results, in three representation forms: the Landau, the proper-time, and the dispersion sum representation. Detailed numerical investigations into many aspects of the physical properties of both the bosonic and fermionic vacua are presented on the basis of these analytical results. From the static and uniform limit of the polarization scalars it is found that the boson vacuum state enhances small electrostatic fields parallel to the external field as well in the transverse direction contrary to the screening behaviour of the fermion vacuum, and all the scalars have a weak logarithmic growth in strong fields. Also contrary to the fermionic behaviour, for wavevectors parallel to the field, the longitudinal dielectric function does not exhibit any singularities at the pair production thresholds. Furthermore the massive longitudinal photon mode found for the magnetised fermion vacuum does not exist in the bosonic equivalent. Like the 1/2-spin case the dispersion solutions show that the purely transverse photon mode acquires mass and is channelled along the field lines - thus manifesting the mixed state of a photon and boson-antiboson quasi-bound state. However, the other mode , which is a combined longitudinal-transverse mode does not deviate significantly from the free-space dispersion law and its inverse lifetime has not singularities at the pair thresholds. 36 refs., 15 figs.

45881 (UM-P–89/110) **Band mixing effects in mean field theories: I. E2 transitions in the interacting boson model-1.** Kuyucak, S.; Morrison, I. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 54p. Order Number DE90635697. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The 1/N expansion method, which is an angular momentum projected mean field theory, is used to investigate the nature of electromagnetic transitions in the interacting boson model (IBM). Conversely, comparison with the exact IBM results sheds light on the range of validity of the mean field theory. It is shown that the projected mean field results for the E2 transitions among the ground, β and γ bands are incomplete for the spin dependent terms and it is essential to include band mixing effect for a correct (Mikhailov) analysis of E2 data. The algebraic expressions derived are general and will be useful in the analysis of experimental data in terms of both the sd and sdg boson models. 17 refs., 7 figs., 8 tabs.

45882 (UWThPh–1990-19) **On current superalgebras and super-schwinger terms.** Grosse, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik); Langmann, E. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 7 May 1990. 9p. Order Number DE90635701. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

We present a general construction of current superalgebras within the framework of quasi-free second quantization of bosons and fermions. Mathematically speaking, we give projective representations of certain Lie superalgebras realized as bounded operators on Z_2-graded Hilbert spaces and, more generally, on Grassmann algebra-modules. The super-Schwinger terms occuring correspond to Z_2-graded two-cocycles. (Authors) 11 refs.

45883 **Space-time approach to holonomy scattering.** Wilczek, F. (School of Natural Sciences, Institute for Advanced Study, Olden Lane, Princeton, New Jersey 08540 (USA)); Wu, Y. *Physical Review Letters (USA)*, 65(1): 13-16 (2 Jul 1990). DOE Contract AC02-76ER02220.

A general concept of holonomy scattering is defined. It applies, among other things, to imply a nontrivial (generally, inelastic) scattering amplitude for the scattering of pure flux tubes off one another, when these fluxes are non-Abelian and do not commute. The amplitudes for such processes, as well as the original Aharonov-Bohm cross section, are calculated directly from an expression for the propagator with a definite winding number.

45884 **Large-N_c higher-order weak chiral Lagrangians coupled to external electromagnetic fields: Applications to radiative kaon decays.** Cheng, H. (Physics Department, Brookhaven National Laboratory, Upton, NY (USA)). *Physical Review, D (Particles Fields) (USA)*, 42(1): 72-84 (1 Jul 1990).

Using factorization and bosonization of quark currents derived from the anomalous Wess-Zumino-Witten terms and from the electroweak perturbations to a QCD-motivated model for nonanomalous p^4 chiral Lagrangians, we obtain leading $1/N_c$ fourth-order $\Delta S=1$ weak chiral Lagrangians coupled to external electromagnetic fields, valid to the zeroth order of gluonic corrections. Applications to radiative K decays, e.g., $K\to\pi\gamma^*\to\pi l^+l^-$, $K\to\pi\gamma\gamma$, $K\to\pi\pi\gamma$, and $K\to\pi l\nu\gamma$, are studied. The twofold ambiguity for the predictions of $K\to\pi l^+l^-$ is suggestively resolved. The branching ratio of $K^\pm\to\pi^\pm\gamma\gamma$ is predicted to be 5.1×10^{-7}, while the current upper bound based on a pion phase-space spectrum is 10^{-6}. The direct $K^\pm\to\pi^\pm\pi^0\gamma$ decays offer an excellent test on both anomalous and nonanomalous weak chiral Lagrangians; the agreement between theory and experiment is marvelous. The branching ratio of the

interference between inner-bremsstrahlung and direct-emission amplitudes in the process $K_L \to \pi e \nu \gamma$ is found to be of order 10^{-5}.

45885 Hadronic mass spectrum in pseudofermion lattice QCD. Campostrini, M. (Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Pisa 156100 (Italy)); Moriarty, K.J.M. *Physical Review, D (Particles Fields) (USA),* 42(1): 203-215 (1 Jul 1990). DOE Contract AC02-86ER40284.

We report on a large-scale calculation of the hadronic mass spectrum in lattice quantum chromodynamics with dynamical quarks using the pseudofermion algorithm. The calculation was carried out on a $10^3 \times 32$ lattice, at a gauge coupling of β=5.70, with three flavors of staggered quarks of mass (ma)=0.05 and 0.10 (in lattice units), and with four values of the acceptance: i.e., 60%, 70%, 81%, and 89%. The hadron masses were obtained from propagators calculated at mass $\hbar a$=ma, but also at $\hbar a$=0.50 and 0.02, in order to study hadronic states with different valence and dynamical quark masses. We also present the results of a calculation on a $10^3 \times 24$ lattice at β=5.47 and ma=0.05 carried out for comparison with the results obtained by Gottlieb, Liu, Toussaint, Renken, and Sugar using the hybrid algorithm. Finally, we suggest a new parameter for a better estimate of the accuracy of the approximations involved in the pseudofermion algorithm.

45886 New look at the Riemann-Cartan theory. Aurilia, A. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309 (USA)); Spallucci, E. *Physical Review, D (Particles Fields) (USA),* 42(2): 464-468 (15 Jul 1990). DOE Contract AC03-76SF00515.

The geometry of torsion in the Riemann-Cartan (RC) theory can be described by an Abelian axial-vector field interacting with the axial-vector fermion current in a purely Riemannian background. On the basis of this observation we note that the Schwinger model formulated in curved spacetime can be interpreted as the two-dimensional version of the RC theory. In two dimensions as well as in four dimensions there is a one-parameter family of regulators that can be used to compute the axial anomaly. In four dimensions we set the value of the arbitrary parameter equal to zero and compute the axial anomaly, including counterterms, using Fujikawa's approach. The addition of the Wess-Zumino Lagrangian changes the original RC theory into a nonanomalous Abelian gauge theory of the torsion field. Guided by the analogy with the Schwinger model, we offer several forms of $L_{gravity}$ from which one can deduce the spin content of the quanta of torsion.

45887 Gauge hierarchy and attractive feeble long-range force. Chang, D. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208 (USA)); Keung, W.; Pal, P.B. *Physical Review, D (Particles Fields) (USA),* 42(2): 630-635 (15 Jul 1990).

We show that in a gauge theory with gauge hierarchy, a long-range attractive feeble force can arise in general within the framework of perturbative field theory. The force is the result of the existence of a Higgs boson whose mass and matter couplings are both naturally suppressed by powers of the hierarchical scale ratio. Some simple but realistic examples are used to demonstrate this mechanism.

45888 Possible second-order phase transition in strongly coupled unquenched planar four-dimensional QED. Oliensis, J. (High Energy Physics Division, Argonne National Laboratory, Argonne, IL (USA)); Johnson, P.W. *Physical Review, D (Particles Fields) (USA),* 42(2): 656-664 (15 Jul 1990). DOE Contract W-31109-ENG-38.

We study chiral-symmetry breaking in four-dimensional QED with N fermion species using truncated Schwinger-Dyson equations, and taking vacuum-polarization effects into account via a momentum-dependent gauge coupling. These effects transmute the infinite-order phase transition found previously for the case of a fixed gauge coupling into a second-order phase transition. For large N, the phase transition may not exist, as it is determined primarily by the physics at the cutoff. We also carry out a preliminary renormalization-group analysis of the theory near the critical coupling: the results are compatible with the existence of a nontrivial continuum limit for the planar theory at the critical value, with an effectively dimensionless fermion field.

45889 Bags via bosonization. MacKenzie, R. (Laboratoire de Physique Nucleaire, Universite de Montreal, Montreal, Quebec (Canada)); Palmer, W.F. *Physical Review, D (Particles Fields) (USA),* 42(2): 701-709 (15 Jul 1990).

The possibility is discussed that fermions which attain a mass through the Higgs mechanism might distort the scalar field background in which they live, forming objects called bags. Although this could equally well happen in other dimensionalities, the (1+1)-dimensional context is considered here. This enables the technique of bosonization, which is indigenous to 1+1 dimensions, to be used. The resulting equations can then be analyzed classically. It is found that in a simple model certain regions of parameter space do have bags as the lowest state with fermion number unity, while in other regions the fermion is actually unstable against decay into a kink-antikink pair, each having a fermion number of one-half. The situation in higher dimensions is speculated upon.

45890 Large polaron in bilocal field theory. Rich, M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)). *Physical Review, A (General Physics) (USA),* 41(11): 5771-5787 (1 Jun 1990).

The formalism of bilocal field theory was applied to the calculation of the ground-state energy and the effective mass of the large polaron. This calculation illustrates the bilocal field method using a relatively realistic model of a physical system. In bilocal theory the fermion field is dependent on two spatial points (nonrelativistically). Fermi particles can then be described in terms of a center of mass and internal wave function, and field operators can be expanded in functions related to the exact one-fermion Green's function, thereby eliminating self-energy terms from the S matrix and related operators. Similarities and differences between calculated large-polaron properties using the bilocal treatment and the customary local treatment are discussed. In particular, it is found that, within the approximations made, the bilocal and local methods give the same leading term in powers of the coupling constant for the ground-state energy and effective mass in the strong-coupling limit. For weak coupling, the bilocal energy is larger (more positive) and the effective mass smaller than in the local case due to an additional kinetic energy of internal motion.

65 PHYSICS II

Refer also to citation(s) 45662

6510 Nuclear Physics

Refer also to citation(s) 45100, 45778, 45785, 45800, 46036, 46050, 46054, 46222

45891 (BNL–44859) **Physics of hot hadronic matter and quark-gluon plasma.** Shuryak, E.V. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–2: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90015682. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This introductory talk contains a brief review of the current status of theoretical and experimental activities related to physics of superdense matter. In particular, we discuss latest lattice results on the phase transition, recent progress in chiral symmetry physics based on the theory of interacting instantons, new in the theory of QGP and of hot hadronic matter, mean p_t and collective flow, the shape of p_t distribution, strangeness production, J/ψ suppression and ϕ enhancement, two puzzles connected with soft pion and soft photon enhancements, and some other "ultrasoft" phenomena. 56 refs., 6 figs.

45892 (CONF-900295–7) **Experimental constraints on binary collision cross sections in the nuclear medium.** Jiang, Jinghua (Kent State Univ., OH (USA). Dept. of Physics); Cogar, J.; Keane, D.; Hartnack, C.; Stoecker, H. Kent State Univ., OH (USA). Dept. of Physics. [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER40531. From 6. workshop on

nuclear dynamics; Jackson Hole, WY (USA); 17-24 Feb 1990. Order Number DE90015284. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Although a significant fraction of the relativistic heavy ion research effort over the past ten years has been directed toward understanding the nuclear equation of state (EOS) in the hadron gas phase, a consensus has yet to be reached on the more limited question of whether the evidence favors the so-called "stiff" or "soft" EOS. A number of difficulties–both theoretical and experimental–have contributed to this situation; this paper focuses on one of these difficulties, i.e., on the topic of determining the cross section for nucleon-nucleon collisions in the nuclear medium, σ_{NN}^{eff}.

45893 (CONF-900970–1) **Time dependent Monte Carlo calculations of the ORELA [Oak Ridge Electron Linear Accelerator] target neutron spectrum.** Cramer, S.N.; Perey, F.G. Oak Ridge National Lab., TN (USA). [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on Monte Carlo methods in neutron and photon transport; Budapest (Hungary); 25-28 Sep 1990. Order Number DE90015156. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The time dependent spectrum of neutrons in the water-moderated Oak Ridge Electron Linear Accelerator (ORELA) target has been calculated using a modified version of the MORSE multigroup Monte Carlo code with an analytic hydrogen scattering model. Distributions of effective neutron distance traversed in the target are estimated with a time and energy dependent algorithm from the leakage normal to the target face. These data are used in the resonance shaped analyses of time-of-flight cross section measurements to account for the experimental resolution function. The 20 MeV–10 eV energy range is adequately represented in the MORSE code by the 174 group VITAMIN-E cross section library with a P_5 expansion. An approximate representation of the ORELA positron source facility, recently installed near the target, has been included in the calculations to determine any perturbations the positron source might create in the computed neutron distributions from the target. A series of coupled Monte Carlo calculations was performed from the target to the positron source and back to the target using a next-event estimation surface source for each step. The principal effect of the positron source was found to be an increase in the distance for the lower energy neutron spectra, producing no real change in the distributions where the ORELA source is utilized for experiments. Different configurations for the target were investigated in order to simulate the placement of a shadow bar in the neutron beam. These beam configurations included neutrons escaping from : (1) the central tantalum plates only, (2) the entire target with the tantalum plates blocked out, and (3) only a small area from the water. Comparisons of the current data with previous calculations having a less detailed model of the tantalum plates have been satisfactory. 10 refs.

45894 (CONF-9007141–1) **Comments on the current status and possible future directions of research on heavy-ion interactions near the Coulomb barrier.** Satchler, G.R. Oak Ridge National Lab., TN (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on heavy-ion collisions at energies near the Coulomb barrier; Daresbury (UK); 5-7 Jul 1990. Order Number DE90015173. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper contains comments on the current status and possible future directions of research on heavy-ion interactions near the Coulomb barrier. Fusion reactions, elastic and inelastic scattering and transfer reactions are discussed. (LSP)

45895 (CONF-9007141–2) **Intimations of neck formation in heavy-ion subbarrier fusion reactions.** Stelson, P.H. Oak Ridge National Lab., TN (USA). Jul 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on heavy-ion collisions at energies near the Coulomb barrier; Daresbury (UK); 5-7 Jul 1990. Order Number DE90015788. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Since the observed fusion cross sections for collisions between heavy ions at subbarrier energies are orders of magnitude larger than would be expected for barrier tunnelling, one is faced with the task of identifying the basic force which is strong enough to overcome the strong Coulomb force and bring about fusion. The two possibilities seem to be excursions of the nuclear surface (and strong nuclear force) due to collective motions of the colliding nuclei and formation of a neck of nuclear matter. The first possibility has received the most attention. However, the systematics of fusion cross sections suggest neck formation is playing an important role. Neck formation can also result in a reseparation of the composite system and we review the experimental information on these reactions at barrier and subbarrier energies. 15 refs., 18 figs.

45896 (DOE/ER/40380–2, pp. 158-167) **Electron scattering and sum rules in nuclear physics.** Gallant, J.N. (Univ. of Massachusetts, Amherst (USA)); Seger, J.E. Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility*. Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The authors consider the importance of sum rules in electron scattering. In particular, they examine the Coulomb and the electric dipole sum rules for nuclei. The physical significance of these rules, and the agreement between theory and experiment, is discussed. 3 refs.

45897 (DOE/ER/40415–15) **Medium energy nuclear physics research: Progress report, October 1, 1989–June 30, 1990.** Peterson, G.A.; Dubach, J.F.; Hicks, R.S.; Miskimen, R.A. Massachusetts Univ., Amherst, MA (USA). Dept. of Physics and Astronomy. Jun 1990. 59p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40415. Order Number DE90015852. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This report discusses papers on the following topics: Electroexcitation of Discrete Levels in ^{13}C at High Momentum Transfers; Elastic Magnetic Electron Scattering from ^{14}Ca; Threshold Electrodisintegration of the Deuteron at High Momentum Transfers; Transverse Form Factors of ^{117}Sn; Longitudinal and Transverse Electron Scattering from ^{7}Li; Large Momentum Transfer Electron Scattering from the Deuteron at 180°; Determination of Nucleon Charge and Magnetic Form factors at $Q^2 = 1.4$ to 6 $(GeV/c)^2$; The PEGASYS Proposal: An Internal Gas Jet Target Facility for SLAC's PEP Storage Ring; Work at the University of Illinois Microtron: Coincidence Studies of the Giant Multipole Resonance in ^{116}Sn Using (e,e'n) Reaction; Experiments Performed and Planned at Bates, NIKHEF, and Lund: Complementary Studies of the $1p_{3/2}$ Radial Wave Function and Mechanisms for Proton Knockout by Real and Virtual Photons; The Preparation of a Review Paper on Giant Magnetic Resonances; and Participation in a Giant Resonance Coincidence Study.

45898 (DOE/ER/40537–1) **[Experimental nuclear physics]: Annual report 1990.** Washington Univ., Seattle, WA (USA). Nuclear Physics Lab. Apr 1990. 100p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40537. Order Number DE90016120. Source: NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

This report contains brief discussion on the following tapes: giant resonances; nucleus-nucleus reactions; nuclear astrophysics; polarization; fundamental symmetries and interactions; accelerator mass spectrometry; instrumentation; accelerators and in sources; and computer systems. (LSP)

45899 (ETDE-IT–90-10) **Search for nuclear phenomena produced by the interaction between titanium and deuterium.** D'Amato, F.; De Ninno, A.; Frattolillo, A.; Scaramuzzi, F.; Zeppa, P. ENEA, Frascati (Italy). Centro Ricerche Energia. 1990. 1p. (CONF-900384–2-Absts.: American Physical Society meeting, Anaheim, CA (USA), 12-16 Mar 1990). Order Number DE90514485. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the A.P.S. general meeting: Hydrogen in Metals (Anaheim, 12-16 March 1990).

Short communication. NUCLEAR REACTIONS/deuterium; NUCLEAR REACTIONS/titanium; DEUTERIUM; TITANIUM; PHASE

STUDIES; NEUTRON EMISSION; NEUTRON DETECTORS; ABSORPTION; DESORPTION; INTERACTIONS

45900 (GSI–90-1) **GSI scientific report 1989.** Grundinger, U. (ed.). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.). Mar 1990. 439p. Order Number DE90517427. Source: NTIS (US Sales Only), PC A19/MF A01.

This annual report contains extended abstracts about the work performed at the named institute. It concerns nuclear structure studies, heavy ion reactions, nuclear theory, atomic collisions, radiation effects in biological systems and solids, nuclear chemistry, as well as developments in counting techniques and accelerators. (orig.).

45901 (JAERI-M–90-025, pp. 69-87) **Benchmark test for fusion reactor.** Maekawa, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The cross section set, as a standard set for fusion neutronics, was prepared for the benchmark test of JENDL-3. The set named FUSION-J3 consists of 40-group gamma and kerma as well as 125-group neutron. This report is based on the benchmark tests performed by four groups. The status of nuclear data is discussed for 14 nuclei in JENDL-3. The Be and Pb data, whose problems were pointed out for JENDL-3T, have improved remarkably. The benchmark test for gamma-ray has been done for only Si, Ti and W. The benchmark tests for the other gamma-ray data and nuclear heating will be carried out soon. (author).

45902 (JAERI-M–90-025, pp. 88-102) **Shielding benchmark test of JENDL-3.** Kawai, M. (Toshiba Corp., Kawasaki, Kanagawa (Japan)); Hasegawa, A.; Ueki, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The integral test of JENDL-3 for shielding application was made on a cross sections of carbon, sodium and iron by analyzing the various shielding benchmark experiments: Broomstick experiments at ORNL for iron and sodium, neutron transmission experiments for sodium at ORNL, iron and carbon, ASPIS deep penetration experiments for iron, measurements of leakage spectrum from iron spheres at KfK, angular neutron spectrum measurements in graphite block at RPI. Analyses were made with radiation transport codes ANISN (1D, Sn), DIAC (1D, Sn), DOT-3.5 (2D, Sn) and MCNP (3D, point Monte Carlo). It was observed that revising JENDL-3T iron data resulted in an improvement in reproducing the experimental data, particularly in the MeV neutron energy region. For sodium, JENDL-3 gave better results than JENDL-2 and ENDF/B-IV. For carbon, JENDL-3 gave better agreement, compared to ENDF/B-IV. The conclusion is that JENDL-3 is highly applicable to the reactor shielding analyses. (author).

45903 (JAERI-M–90-025, pp. 103-114) **Benchmark test of JENDL-3 Dosimetry file.** Nakazawa, M. (Tokyo Univ. (Japan)). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Present status of JENDL-3 Dosimetry-file has been reviewed, and generally better agreements have been obtained for the dosimetry reaction rates between calculation and experiment in several benchmark neutron fields such as Cf-252 fission spectrum. In this comparison, special attention has been paid to the uncertainty estimations of each reaction rate values. The covariance of reaction cross-section of IRDF has been tentatively applied here and the covariance of benchmark neutron spectrum has been assumed practically. (author).

45904 (JAERI-M–90-025, pp. 156-166) **Review of nuclear data required for nuclear transmutation systems of long-lived radioactive waste utilizing particle accelerators.** Kishida, Norio (Century Research Center Corp., Tokyo (Japan)). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

In order to reduce the period for management of long-lived radioactive waste produced from nuclear fuel cycle facilities, waste disposal procedures based on nuclear transmutation have been proposed by several groups. Two of the proposed procedures are to utilize particle accelerators; one utilizes a high energy proton linac and the other a high energy electron linac. The former procedure intends to use the nuclear transmutation by proton-induced spallation reactions and the later one by photonuclear reactions with bremsstrahlung photon beams. If there are no evaluated nuclear data concerning the above two reactions, neutronic characteristics of transmutation facilities will not become clear. Cross-sections of both reactions are not included in currently existing neutron data files such as JENDL-3. Moreover these cross-sections reveal quite different behavior in comparison with those of low-energy neutron-induced reactions. In the present paper, reviewed are the current status and problems of experimental and evaluated nuclear data of the two reactions; because these data highly important to calculation on the neutronics of the transmutation facilities. (author).

45905 (JAERI-M–90-025, pp. 295-312) **Comparison of calculated shielding properties by JENDL-3 with those by ENDF/B-IV.** Maki, Koichi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Seki, Yasushi; Kosako, Kazuaki; Maekawa, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Fusion nuclear group constant set 'FUSION-J3' has been constructed from JENDL-3, Japanese evaluated nuclear data file, published in September 1989. Using FUSION-J3, shielding properties were calculated in fusion reactor inboard shield to guard for superconductive toroidal magnets against neutron and gamma ray. The results were compared with those by the nuclear group constant set VITAMIN-C based on ENDF/B-IV. From the comparison, both neutron spectra in the first wall with FUSION-J3 and VITAMIN-C are in approximately agreement with each other. The former in winding pack is less than the latter by 30 % in the energy region below 1 keV. Gamma ray spectra with FUSION-J3 are larger than 1.5-3 times of those by VITAMIN-C in the first wall and this discrepancy becomes larger in the winding pack region far from the first wall. (author).

45906 (JAERI-M–90-025, pp. 362-373) **Proton induced spallation reaction calculation considering the intranuclear high-momentum nucleons and the preequilibrium effect.** Ishibashi, K. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Miura, Y.; Sakae, T. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The double differential cross section of neutron production is calculated for the spallation reaction that is induced by incident protons of several hundred MeV. The intranuclear nucleons with high-momentum component are introduced into the High Energy Transport Code (HETC). The consideration of such nucleons is useful in the reproduction of the yield of the high-energy neutrons in the backward direction. The intranuclear cascade process calculation is terminated taking the preequilibrium effect into account in a local manner. The use of this method successfully represents the shape of the neutron spectra of an intermediate energy. (author).

45907 (KEK–89-12, pp. 181-194) **Phase-shift analyses of proton-proton scattering data at the energies 2-12 Gev/c and an evidence of repulsive spin-orbit interaction.** Matsuda, Masanori (Hiroshima Univ. (Japan). Faculty of Integrated Arts and

Sciences). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–: Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

The author's previous studies have given a possible evidence of a strong repulsive spin-orbit interaction through phase-shift analyses of p-p scattering data at P_L = 6 and 12 GeV/c. To confirm this evidence, the present study focuses on p-p scattering experiment in the laboratory momentum region of 2-4 GeV/c. The report describes results of preliminary analyses of experimental data available at present and those interpolated by the spline-function method in this energy region. Results of the preliminary phase-shift analyses at P_L = 2-4 GeV/c show that the spin-orbit phase shift of P-wave rapidly decreases as the incident energy exceeds about 2 GeV/c. Such an energy dependence of the phase shift suggests the existence of a strong repulsive short-range spin-orbit interaction which is different from the attractive long range one due to lower meson exchanges. The value of the phase shift seem to reach a maximum at 1.4 - 2 GeV/c, where the P-wave impact parameter is 0.4 - 0.5 fm, suggesting that the repulsion of short range spin-orbit interaction becomes prominent at above 0.5 fm. The behaviour of the F-wave also seems to be consistent with this interpretation. (N.K.).

45908 (KURRI-TR–333) **Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor.** Yoshizawa, Yasukazu (Hiroshima Univ. (Japan). Faculty of Science); Kawase, Yoichi; Okano, Kotoyuki (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1990. 101p. (In Japanese). (CONF-9001108–: 2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, Kumatori (Japan), 17-18 Jan 1990). Order Number DE90513872. Source: NTIS (US Sales Only), PC A06/MF A01.

This issue is the collection of the papers presented at the title meeting. The 14 of the presented papers are indexed individually. (J.P.N.).

45909 (LA–11875-PR) **Physics Division progress report, January 1, 1989–December 31, 1989.** Shera, E.B. (comp.); Hollen, G.Y. (ed.). Los Alamos National Lab., NM (USA). Aug 1990. 89p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. Order Number DE90016655. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

This report provides selected accounts of significant progress in research and development achieved by Physics Division personnel during the period January 1, 1989, through December 31, 1989. It also provides a general description of the goals and interests of the Division, very brief descriptions of projects in the Division, and a list of publications produced during this period. The report represents the three main areas of experimental research and development in which the Physics Division serves the needs of Los Alamos National Laboratory and the nation in defense and basic sciences: (1) fundamental research in nuclear and particle physics, condensed-matter physics, and biophysics; (2) laser physics and applications, especially to high-density plasmas; and (3) defense physics, including the development of diagnostic methods for weapons tests, weapons related high energy-density physics, and programs supporting the Strategic Defense Initiative.

45910 Techniques for the study of chemical and physical properties of the heaviest elements. Gregorich, K.E. (Lawrence Berkeley Laboratory, CA (USA)). pp. 1, Paper NUCL 3 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904151–: Analytical applications of nuclear chemistry: award symposium honoring Ronald D. MacFarlane, Dallas, TX (USA), 9-14 Apr 1989).

Techniques used in recent studies of the chemical and nuclear properties of elements 103-105 will be discussed. Similar techniques have also recently been used in the study of electron capture-delayed fission of neutron-deficient actinides. These techniques allow the study of isotopes with sub-minute half-lives and production rates of less than one atom per minute. A review of recent results will also be presented.

45911 Dependence of the shape of alpha-particle evaporation spectra on nuclear deformation. Huizenga, J.R. (Univ. of Rochester, NY (USA)); Behkami, A.N.; Govil, I.M.; Schroeder, W.U.; Toke, J. pp. 3, Paper NUCL 8 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

The study of particle evaporation spectra and multiplicities allows one to probe equilibration processes in nuclear collisions. Such experimental spectra are usually analyzed with standard statistical models. Over the last decade, a number of measurements have been made of charged-particle evaporation spectra from heavy-ion fusion reactions, where higher excitation energies and angular momenta are involved. Based on analyses of these spectra, some authors have claimed that the intermediate composite nuclei have extremely large deformations (e.g., up to c/a = 3), much in excess of predictions based on the rotating liquid drop model (RLDM). The dependence of the shape of charged-particle spectra on nuclear deformation will be discussed both in terms of the transmission coefficients and the spin-dependent level density of deformed nuclei. Statistical model calculations to be presented reproduce available spectra data with deformations that are in approximate agreement with the RLDM.

45912 Cyclotron, positrons and PET [positron emission tomography]. An overview. Wolf, A.P. (Brookhaven National Laboratory, Upton, NY (USA)). pp. 4, Paper NUCL 12 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904154–: Symposium on rapid organic synthesis with the short-lived positron emitters: challenges in radiotracer development for PET, Dallas, TX (USA), 9-14 Apr 1989).

PET (positron emission tomography) is a powerful new scientific tool which is capable of revealing biochemical transformations while they are occurring in the brain and other organs in the living human body. The application of PET to problems in biology and medicine is dominated by the short half-life of the isotopes used to prepare the radiotracers. The most commonly used positron emitting isotopes are carbon-11, fluorine-18, nitrogen-13, and oxygen-15 which have half-lives of 20.4, 110, 10 and 2 minutes, respectively. Their incorporation into radiotracers having diverse chemical structures and biochemical specificities has allowed the study of blood flow, sugar metabolism, oxygen metabolism, neurotransmission, enzyme activity and binding sites for therapeutic drugs and substances of abuse. PET research is most commonly carried out at a Cyclotron-PET Center (cyclotron, positron emission tomography, chemistry laboratory) where the short-lived isotopes can be produced and used efficiently. The number of Cyclotron-PET Centers has grown from 4 in 1976 to several dozen in 1988 and the number is expected to double in the next five years attesting to the vitality of the field and the current and anticipated contributions to research in biology and medicine.

45913 Desorption of organic molecules with fast incident atomic and polyatomic ions. Hunt, J.E. (Argonne National Laboratory, IL (USA)); Salehpour, M.; Fishel, D.L. pp. 6, Paper NUCL 21 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract W-31-109-ENG-38. (CONF-8904151–: Analytical applications of nuclear chemistry: award symposium honoring Ronald D. MacFarlane, Dallas, TX (USA), 9-14 Apr 1989).

In 1974, Macfarlane and coworkers introduced a new mass spectrometric technique based on desorption-ionization of sample molecules from solid targets by the impact of fast heavy ions (fission fragments) from ^{252}Cf. The process of ion-induced desorption of molecular ions from surfaces is not yet fully understood, although a large amount of experimental data related to the mechanism has been published. This paper concerns the use of fast incident polyatomic ions to induce desorption of secondary molecular ions of valine and chlorophyll from surfaces. Polyatomic ions are unique in that they are a collection of temporally and spatially

correlated atoms. The main finding in this study is that incident polyatomic ions produce drastic enhancements in the secondary ion yields over atomic ions. Also, two types of nonlinear effects in desorption have been observed and will be discussed.

45914 The decomposition of incomplete fusion. Sobotka, L.G. (Washington Univ., St. Louis, MO (USA)); Sarantites, D.G.; Stracener, D.W.; Majka, Z.; Abenante, V.; Semkow, T.M.; Hensley, D.C.; Beene, J.R.; Halbert, M.L. pp. 7, Paper NUCL 26 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153--: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

The velocity distribution of fusion-like products formed in the reaction of 701 MeV $^{28}Si+^{100}Mo$ is decomposed into 26 incomplete fusion channels. This is accomplished by detecting the evaporation residue in coincidence with most of the associated charged particles, as well as most neutrons and γ-rays emitted to laboratory angles greater than 35°. The incomplete fusion channels are defined by the forward non-evaporative charge (Z_f) and its associated mass (Z_f). The momentum deficit of the residue per non-evaporative mass unit is approximately equal to the beam momentum per projectile nucleon (P_o/A_p). The multiplicity of neutrons, light charged particles and heavy ions emitted in the backward direction are all indicators of the extent of momentum transfer, with the heavy-ion multiplicity being the most sensitive. Proton angular distributions coincident with residues which have velocities greater than that for full momentum transfer exhibit backward peaking. While this is expected from momentum conservation considerations, it may be an indication of backward nucleon jetting.

45915 Radiohalogenated amphetamine analogs for blood flow and serotonin receptor studies. Mathis, C.A. (Lawrence Berkeley Lab., CA (USA)); Gerdes, J.M.; Shulgin, A.T.; Nichols, D.E. pp. 9, Paper NUCL 31 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904154--: Symposium on rapid organic synthesis with the short-lived positron emitters: challenges in radiotracer development for PET, Dallas, TX (USA), 9-14 Apr 1989).

The 4-radiohalo-2,5-dimethoxyamphetamine hallucinogens were first utilized in the 1970's for cerebral imaging studies by T. Sargent and A.T. Shulgin. Subsequently, other radioiodinated amphetamine analogs and distantly related diamines have been synthesized and used for clinical single photon studies of cerebral blood flow. A generator system for the production of the short-lived positron emitter ^{122}I (3.5 min half-life) was developed, and several amphetamine and diamine compounds have been labeled with ^{122}I for positron emission tomography (PET) studies of regional cerebral blood flow in animals and humans. The short half-life of ^{122}I requires that the radiochemical syntheses be rapid and efficient. Both electrophilic deprotonation and demetallation reactions have been utilized to achieve this goal. Recently, there has been considerable evidence that some 4-halo-2,5-dimethoxyamphetamine analogs are highly specific serotonin receptor agonists. This has lead to the speculation that the binding of these agonists to a serotonin 5-HT_2 receptor sub-type may be involved in hallucinogenesis. In an effort to help elucidate the role of these agents, several radioiodinated and radiobrominated 4-halo-2,5-dimethoxyamphetamine analogs have been synthesized for in vitro binding studies. Studies examining the in vivo interaction of these analogs with serotonin 5-HT_2 receptors have been initiated with the synthesis of 4-(^{18}F)fluoroalkyl-2,5-dimethoxyamphetamines.

45916 Non-equilibrium versus equilibrium emission of complex fragments from hot nuclei. Viola, V.E. (Indiana Univ., Bloomington (USA)); Kwiatkowski, K.; Yennello, S.; Fields, D.E. pp. 11, Paper NUCL 41 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153--: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

The relative contributions of equilibrium and non-equilibrium mechanisms for intermediate-mass fragment emission have been deduced for Z=3-14 fragments formed in ^{3}He- and ^{14}N-induced reactions on Ag and Au targets. Complete inclusive excitation function measurements have been performed for ^{3}He projectiles from E/A=67 to 1,200 MeV and for ^{14}N from E/A=20 to 50 MeV. The data are consistent with a picture in which equilibrated emission is important at the lowest energies, but with increasing bombarding energy the cross sections are increasingly dominated by non-equilibrium processes. Non-equilibrium emission is also shown to be favored for light fragments relative to heavy fragments. These results are supported by coincidence studies of intermediate-mass fragments tagged by linear momentum transfer measurements.

45917 New uses of the Sandia-Albuquerque nuclear microprobe. Doyle, B.L. (Sandia National Laboratories, Albuquerque, NM (USA)); Lee, S.R.; Barbour, J.C. pp. 13, Paper NUCL 47 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC04-76DP00789. (CONF-8904160--: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

Nuclear microprobe analysis finds its greatest utility for studies requiring extremely high sensitivity, non-destructive depth profiling, quantitative light element detection and for in-air analyses. While the external-beam examination of deuterium accumulation and impurity deposition on fusion reactor components remains the primary application of the Sandia-Albuquerque probe, new uses of the probe in materials research areas have been found recently. These areas include: high temperature superconductors, buried layers in semiconductors, tribology, and failure analysis of integrated circuits. This paper will review these new application areas in addition to highlighting examples of newly developed external D-profiling capability.

45918 Chemical effects on target X-rays produced by heavy-ion impact. Vane, C.R. (Oak Ridge National Laboratory, TN (USA)); Raman, S.; Walkiewicz, T.; Kahane, S.; Rosseel, T.M. pp. 13, Paper NUCL 48 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC05-84OR21400. (CONF-8904160--: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

The authors have measured complete aluminum K X-ray spectra from a variety of aluminum alloys and compounds excited by 84 MeV S^{8+} ions from the Holifield Heavy Ion Tandem accelerator. These spectra were obtained at the highest resolution to date using a von Hamos, broad-band crystal spectrometer in an attempt to observe variations in the numerous individual multiplet transitions which make up the separate KLn satellite peaks. Aluminum displays only very weak spectral changes. The greatest variations observed occur in the overlapping $K\beta L^n/K_\alpha{}^2L^n$ region. The $K\beta L^n$ component is almost completely missing from the oxide spectrum. The difference must result from variations in the times required to reestablish M-electrons which are almost certainly initially ionized in these violent K-vacancy forming collisions.

45919 High-resolution X-ray studies of the chemical environment of ions implanted in insulator matrices. Rosseel, T.M. (Oak Ridge National Laboratory, TN (USA)); Young, J.P.; Zuhr, R.A.; Vane, C.R.; Jones, N.L.; Peterson, R. pp. 14, Paper NUCL 49 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC05-84OR21400. (CONF-8904160--: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

The authors have initiated a project to study the chemical environment of ions implanted in insulator matrices, e.g. SiO_2 (quartz), as a function of the initial charge state, concentration, energy (depth), deposition rate and substrate matrix using heavy-ion-induced X-ray satellite emission (HIXSE) spectroscopy. HIXSE is an X-ray fluorescence technique which uses fast (>1MeV/amu), heavy ions for excitation and yields intense, chemically-sensitive satellite lines. Because HIXSE non-destructively probes the near-surface region (≈5 - ≈500 nm), unlike surface-science techniques, it is ideally suited for the examination of the local chemistry of implanted ions and thin film interfaces. Results will be presented which demonstrate ability to detect changes in the local chemistry

of implanted ions at concentrations of less than 0.1 at % (integrated over the sampling range) and at depths ranging from 40 to 300 nm.

45920 3D imaging of fast molecular ions. Kanter, E.P. (Argonne National Laboratory, IL (USA)). pp. 18, Paper NUCL 63 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract W-31-109-ENG-38. (CONF-8904160–: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

A knowledge of the structures and dynamics of molecular ions is one of the keys to understanding their roles in interstellar clouds, laboratory plasmas, and atmospheric chemistry. In this talk, the author will describe a radically new approach to studying the stereostructures of such molecules – a method that has been termed Coulomb Explosion Imaging. As a result of the very rapid (~ femtoseconds) Coulomb Explosion, a complete measurement of the 3N velocity components of all of the fragments resulting from the foil-induced dissociation of a fast (MeV) molecular ion produces an image of the geometrical configuration of the atomic constituents within the original molecule. The development of a unique MUltiParticle Position And Time Sensitive (MUPPATS) detector system has permitted such measurements for large ensembles of molecular ions, providing a very different perspective on molecular structure than has hitherto been available experimentally. Results of several recent experiments will be discussed, including studies of small carbocations such as $C_2H_3^+$, and the cluster ions C_3^+ and Al_3^+.

45921 Structure of molecules and clusters as determined by Coulomb explosions. Vager, Z. (Argonne National Laboratory, IL (USA)). pp. 18, Paper NUCL 64 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904160–: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

A novel method for the study of structure and dynamics of small molecules will be presented. The studied species is accelerated to a speed such that when it collides with an extremely thin foil, a vertical transition occurs to a state of highly charged atomic ions. A pure Coulomb dissociation occurs among the positive ions. The final vector velocity of each fragment is recorded simultaneously for all the constituents and the joint velocity vectors of the ions can be converted back to the original positions of atoms in the studied species. The ensemble of such measurements provides the correlated density function of all the position degrees of freedom within the studied molecule. This may open up a new perspective on the science of physical chemistry of small molecules, molecular ions and clusters. A specific example, the fluctuational behavior of the CH4+ ion as seen from the Coulomb-Explosion results, will be given. A major improvement of the Coulomb explosion method is the inclusion of a careful selection of the quantum state(s) of the measured species. An account of the state of the art of such improvements will be included.

45922 The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission. Moretto, L.G. (Lawrence Berkeley Laboratory, CA (USA)); Wozniak, G.J. pp. 19, Paper NUCL 67 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC03-76SF00098. (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

A sharply defined source of complex fragments formed in the complete or incomplete fusion at intermediate energy produces complex fragments in a binary decay characteristic of compound nucleus decay. In more symmetric systems, a continuous distribution of sources is found, corresponding to the full range of incomplete fusion processes. By gating on source velocity, the authors obtain velocity diagrams with sharp Coulomb circles and Z1-Z2 correlation diagrams clearly reflecting the incomplete fusion required by the source velocity. At higher bombarding energies (80-100A MeV), the asymmetric systems La+C, Al still reveal the presence of a sharp binary source. However, peculiar angular distributions varying with the fragment atomic number and U-shaped charge distributions indicate the presence of dynamical effects most likely associated with the impending termination of incomplete fusion and with the decoupling of the fireball. Ternary events in these reactions show the same center-of-mass velocities and the same total charge spectrum as the binary events. Dalitz plots of the associated charge distributions suggest a sequential binary mechanism.

45923 From fission to multifragmentation. Lopez, J.A. (Lawrence Berkeley Laboratory, CA (USA)); Randrup, J. pp. 20, Paper NUCL 68 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

Heavy ion collisions are known to have different reaction mechanisms depending on the beam energy. While binary fission is the most likely outcome at energies about 1-2 MeV/A, at intermediate energies (say above 5 MeV/A) several medium size fragments are usually produced. Here the authors report on a study on how this change of mechanisms takes place. They use the Bohr-Wheeler transition state method of binary fission generalized to higher breakup modes. They also contrast the kinematical observables obtained under a sequential production of fragments with those of a simultaneous multifragmentation with the hope of identifying the breakup mechanism.

45924 Highly charged quasi-molecules—ion-atom collision studies at the LBL ECR ion source. Prior, M.H. (Lawrence Berkeley Laboratory, CA (USA)). pp. 22, Paper NUCL 76 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904160–: Symposium on chemical applications of particle accelerators, Dallas, TX (USA), 9-14 Apr 1989).

This presentation will summarize studies carried out with low energy (≈ 10 keV x q) highly charged (e.g. q=6-17) projectile ions in collision with atomic gas targets. In this context, low energy means projectile velocities less than the velocities of the active electrons in the atomic target. The ions are produced by the LBL Electron Cyclotron Resonance (ECR) ion source located at the 88-inch cyclotron. The studies include observation of X-ray spectra from electron transitions within the quasi-molecule formed in the collision, detailed analysis of angular scattering following electron transfer events, and Auger electron spectra from multiply excited projectile states formed in the collision. The quasi-molecular model is important to the understanding of many of the phenomena observed in these collisions. The work described was done in collaboration with groups from U. Frankfurt, Kansas State University, and V-Division of Lawrence Livermore National Laboratory.

45925 Multiple decomposition of projectiles at intermediate energies. Pouliot, J. (Lawrence Berkeley Laboratory, CA (USA)); Chan, Y.D.; Dacal, A.; DiGregorio, D.E.; Harmon, B.A.; Knop, R.; Ortiz, M.E.; Plagnol, E.; Stokstad, R.G.; Moisan, C.; Potvin, L.; Rioux, C.; Roy, R. pp. 23, Paper NUCL 79 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

An array of 34 fast/slow plastic scintillators has been used to identify fragments from the breakup of ^{16}O, ^{14}N, and ^{12}C projectiles at 32.5 MeV/A, scattered by several targets. The dissociation of ^{16}O into as many as five charged particles has been observed. The yields of the different channels correlate approximately with the threshold energy for separation of the projectile into the observed fragments. The excitation energy spectrum of the primary projectile fragment was deduced from the measured positions and kinetic energies of the individual fragments. These spectra show that excitation energies extending up to ~ 80 MeV can be produced in the primary stage of the reaction. This represents a significant acquisition of energy by the projectile. Calculations of the yields based on a sequence of binary decays will be presented. The question of prompt or sequential decay will also be addressed.

45926 Complex fragment emission from Nb+Au reactions at 50 to 100 MeV/A. Namboodiri, M.N. (Lawrence Livermore National

Laboratory, CA (USA)); Britt, H.C.; Fields, D.J.; Hansen, L.F.; Lanier, R.; Massoletti, D.; Remington, B.; Sangster, T.C.; Struble, G.L.; Webb, M.L.; Begemann-Blaich, M.; Blaich, T.; Fowler, M.; Wilhelmy, J.; K pp. 26, Paper NUCL 91 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract W-7405-ENG-48. (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

In order to understand the nature of multifragmentation in intermediate energy heavy ion collisions, the authors have made exclusive measurements on the target and projectile fragments from the system Nb+Au at 50, 75, and 100 MeV/A using a position-sensitive multielement logarithmic detection system which covers about 10 percent of 4 π. Three broad classes of products can be distinguished among the target decay fragments: intermediate mass fragments, fission fragments, and heavy residues. Correlations of the target fragments with projectile fragments and light particles yield information on impact parameter and excitation energy. Cross sections and correlations in mass, velocity, and emission angle for the different types of fragments will be presented and their implications regarding the mechanism of fragment production will be discussed.

45927 Extraction of global variables from intermediate energy nucleus-nucleus collisions. Ogilvie, C. (Michigan State Univ., East Lansing (USA)); Westfall, G.; Cebra, D.; Clayton, J. Howden, S.; Karn, J.; Vander Molen, S.; Nadasen, A.; Wilson, K.; Winfield, J. pp. 27, Paper NUCL 93 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

Global variables such as entropy and energy/momentum flow have been extracted from 40Ar+V and 40Ar+Au collisions at 35 MeV/nucleon and 12C+C and 12C+Au collisions at 50 MeV/nucleon using the MSU 4π Array. General results such as angular distributions for particles from central collisions will be discussed and compared to the predictions of Quantum Molecular Dynamics of Stocker et al. The entropy produced is extracted by studying the relative production of light nuclei as a function of impact parameter-related quantities such as the charged particle multiplicity. The ratios and resulting entropies are very different from Ca+Ca results at 400 MeV/nucleon measured by the Plastic Ball group indicating that a completely different regime of thermodynamic behavior is being explored at these intermediate energies. Flow is extracted from the Ar+V system at 35 MeV/nucleon and compared to the Plastic Hall results and to VUU calculations. Effects on the extraction of flow related to the finite multiplicity of particles will be discussed.

45928 Response of an iron-scintillator calorimeter to relativistic heavy ions. Kaufman, S.B. (Argonne National Laboratory, IL (USA)); Betts, R.R.; Beavis, D.; Chu, Y.Y.; Cumming, J.B.; Duek, E.; Haustein, P.; Katcoff, S.; Juricic, I.; Bloomer, M.A. pp. 30, Paper NUCL 105 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract W-31-109-ENG-38. (CONF-8904152–: American Chemical Society Division of Nuclear Chemistry and Technology, Dallas, TX (USA), 9-14 Apr 1989).

An iron-scintillator sampling calorimeter for the measurement of the energy remaining in projectile-like fragments after the interaction of relativistic heavy ions with complex nuclei is described. The response to charge- and mass-identified ions from ^{4}He to ^{16}O, with kinetic energies of 13.6 GeV/nucleon, was measured. The energy response was linear over this energy range, and the resolution was measured to be $\sigma/E=0.73/(E[GeV])^{\frac{1}{2}}$. Some factors influencing the resolution of heavy-ion calorimeters will be discussed.

45929 Organic analysis of nuclear wastes: An excursion to the hot cell. Toste, A.P. (Southwest Missouri State Univ., Springfield (USA)); Lechner-Fish, T.J.; Scheele, R.D. pp. 31, Paper NUCL 106 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904152–: American Chemical Society Division of Nuclear Chemistry and Technology, Dallas, TX (USA), 9-14 Apr 1989).

Analytical methods are being developed for the chemical characterization of nuclear wastes, ranging from low-level commercial wastes to defense wastes. The organic analyses, in particular, have proven to be quite a challenge. The wastes can be very complex: multiphasic, very alkaline or acidic, highly ionic, and extremely radioactive, e.g., 10 R/h. Samples of such wastes have to be prepared in a hot cell facility equipped with remote manipulators. Complex EPA methods for volatile and semivolatile organics have been successfully adapted to the constraints of the radiation facilities. Analytical methods have also been developed for nuclear-related organics not specified by EPA methods, e.g., hydrophilic organics such as chelating and complexing agents, as well as their degradation products, using gas chromatography (GC) and combined GC-mass spectrometry (GC/MS). The organic content of nuclear wastes analyzed to date can be quite complex and abundant, ranging from nonpolar to polar organics. Organic diagenesis, or degradation of source-term organics, can be quite vigorous in nuclear wastes.

45930 Sorption of nickel and neptunium in tuff. Knight, S.D. (Los Alamos National Laboratory, NM (USA)); Lawrence, F.O. pp. 31, Paper NUCL 107 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904152–: American Chemical Society Division of Nuclear Chemistry and Technology, Dallas, TX (USA), 9-14 Apr 1989).

Nickel and neptunium both are elements of importance in nuclear waste isolation studies. Sorption measurements for these elements have been performed with Yucca Mountain tuffs using three natural groundwaters of various compositions. The tuff samples were of the different sorptive varieties that have been identified at Yucca Mountain. One of the groundwaters was typical of the area wells and the other two represented extremes in groundwater composition found at Yucca Mountain. The neptunium measurements were performed under ambient and controlled-atmosphere conditions. Sorption coefficients were determined for nickel and neptunium and the results will be discussed and reported as a function of groundwater composition and of ambient or controlled-atmosphere conditions.

45931 Proposed experiments with macro amounts of ^{93m}Nb. Grover, J.R. (Brookhaven National Laboratory, Upton, NY (USA)). pp. 32, Paper NUCL 109 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). (CONF-8904152–: American Chemical Society Division of Nuclear Chemistry and Technology, Dallas, TX (USA), 9-14 Apr 1989).

The author proposes to prepare milligram samples of ^{93m}Nb that are reasonably pure. This will make possible for the first time many fascinating comparisons with ground state (natural) ^{93}Nb, with respect to nuclear, atomic and bulk matter properties. In particular, some longstanding problems in nuclear reactions can be addressed. The ^{93m}Nb will be obtained from the beta-decay of aged fission-product Zr; one kilogram of ^{93}Zr generates in the course of one year 0.5 mg of ^{93}Nb consisting of 97% ^{93m}Nb and 3% ^{93g}Nb, assuming that the decay of ^{93}Zr is 100% to ^{93m}Nb. An especially interesting experiment will be to irradiate a crystal of ^{93m}Nb or one of its compounds with synchrotron photons at the Bragg angle for a suitable reflection, to measure the acceleration of radiative decay. Such acceleration has already been observed for the 14-keV state of ^{57}Fe. The stimulated emission of the 30.4-kev photons of the isomeric transition of ^{93m}Nb is expected to be highly directional.

45932 Brookhaven experiment E-802. Chasman, C. (Brookhaven National Laboratory, Upton, NY (USA)). pp. 32, Paper NUCL 111 of American Chemical Society, Division of Nuclear Chemistry and Technology, national meeting. American Chemical Society, Washington, DC (US) (1989). DOE Contract AC02-76CH00016. (CONF-8904153–: Symposium on nuclear dynamics and nuclear disassembly, Dallas, TX (USA), 9-14 Apr 1989).

Brookhaven E-802 is a magnetic spectrometer experiment which is directed towards the measurement of particle momentum spectra and particle-particle correlations following reactions with 14.5 GeV/u O and Si ions. In addition to the spectrometer there are detectors

to measure the transverse energy flow, longitudinal energy flow, and the multiplicity. These detectors can be used to characterize the particle spectra or correlated between themselves. Particle spectra have been obtained for protons, pions, and kaons using targets of gold, copper, and aluminium although the data are not entirely analyzed as yet. A first result that is of great interest is the K^+/π^+ ratio for Si + Au reactions which is larger than expected on the basis of the known p+p data.

6511 Experimental Techniques

Refer also to citation(s) 45720, 45899, 45910, 45911, 45917, 45919, 45920, 45921, 45924, 45925, 45926, 45927, 45928, 45931, 45932

45933 (LBL–29172) **The synthetic elements.** Hoffman, D.C. Lawrence Berkeley Lab., CA (USA). May 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9008129–1: 11. biennial conference on chemical education, Atlanta, GA (USA), 5-9 Aug 1990). Order Number DE90015638. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Prior to 1940, the heaviest element known was uranium, discovered in 1789. Since that time the elements 93 through 109 have been synthesized and identified and the elements 43, 61, 85, and 87 which were missing form the periodic tables of the 1930's have been discovered. The techniques and problems involved in these discoveries and the placement of the transuranium elements in the periodic table will be discussed. The production and positive identification of elements heavier than Md (Z=101), which have very short half-lives and can only be produced an atom-at-a-time, are very difficult and there have been controversies concerning their discovery. Some of the new methods which have been developed and used in these studies will be described. The prospects for production of still heavier elements will be considered.

6512 Nuclear Properties and Reactions, A = 1-5, Experimental

Refer also to citation(s) 46037, 46039, 46206, 46207

45934 (ANU-P–1050) **Static and dynamic moments of the ^{7}Li nucleus.** Barker, F.C. (Australian National Univ., Canberra (Australia). Dept. of Theoretical Physics); Kondo, Y.; Spear, R.H. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Sep 1989. 24p. Order Number DE90636385. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Also published in Aust. J. Phys., 1989 v. 42(6).

The data of Weller et al. (1985) on the tensor analysing powers for elastic and inelastic Coulomb scattering of aligned ^{7}Li ions have been reanalyzed in order to obtain information on the values of the four ^{7}Li moments Q, B(E2)↑, τ_{11} and τ_{12}. It is shown that a single set of values, chosen primarily to be consistent with the value of Q measured by molecular techniques and the values of B(E2)↑ and τ_{12}, required to fit unpolarized ^{7}Li data, and also with the theoretical constraint $\tau_{11} \simeq -[\tau_{12}]$, gives a good fit to the aligned ^{7}Li data. 19 refs., 6 figs.

45935 (BNL–44861) **Strange experiments at the AGS.** Chrien, R. Brookhaven National Lab., Upton, NY (USA). [1990]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900601–3: 12. international conference on particles and nuclei, Cambridge, MA (USA), 24-29 Jun 1990). Order Number DE90015679. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The purpose of this review is to report recent progress in nuclear experiments involving strangeness which have been carried out at the Brookhaven Alternating Gradient Synchrotron over the past three years. These recent developments are noted in three areas: few body systems and dibaryons; strange probes of the nucleus; and associated production of hypernuclei. 9 refs., 3 figs.

6513 Nuclear Properties and Reactions, A = 6-19, Experimental

Refer also to citation(s) 46015, 46206, 46207

45936 (BNL–44898) **Particle production in Si + A and p + A collisions at 14.6 A·GeV/c.** Miake, Y. E-802 Collaboration. Brookhaven National Lab., Upton, NY (USA). [1990]. 6p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration; US-Japan High Energy Physics Collaboration Treaty. DOE Contract AC02-76CH00016. (CONF-900570–7: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90016325. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Particle production ($\pi^\pm$, $K^\pm$, p) has been measured in both Si+A and p+A collisions at 14.6 A·GeV/c. Comparisons of m_t and dn/dy distributions between p+Be, p+Au and central Si+Au collisions are discussed. 8 refs., 3 figs.

45937 (DOE/ER/40380–2, pp. 142-157) **Electroproduction and inelastic charge scattering from carbon and iron.** DeAngelis, D.J. (Univ. of New Hampshire, Durham (USA)); Spengos, M.; Williams, J.Z. Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

Electroproduction of the Δ isobar in C and Fe has been studied for incident electrons with energies between 0.6 and 1.6 GeV. A longitudinal-transverse decomposition of the inclusive cross section has been made for $q^2_\mu = 0.1(GeV/c)^2$. The residual longitudinal cross sections measured do not provide the additional strength needed above the quasifree region to satisfy the Coulomb sum rule. The transverse cross sections are in good agreement with data from photoabsorption.

45938 (JAERI-M–90-025, pp. 208-215) **Nuclear data of charged-particle induced reactions on light nuclei.** Koori, N. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Watanabe, Y.; Eriguchi, M.; Hyakutake, M.; Wakuta, Y.; Kumabe, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Theoretical interpretation of the ^{6,7}Li(p,p') scattering data, especially their analyzing powers, are described. Cross sections and analyzing powers of proton scattering are compared with those of neutron scattering. Furthermore, new data are given for the ^{6}Li(p,2p)nα and ^{12}C(p,p')3α reactions, which are mirror ones of ^{6}Li(n,2n)pα and ^{12}C(n,n') 3α reactions, respectively. (author).

45939 (LYCEN–89-02 C.5.1-C.5.14) **Recent results on the spectroscopy of light nuclei at GANIL.** Dufour, J.P. (Institut National de Physique Nucleaire et de Physiques des Particules (IN2P3), 75 - Paris (FR)). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Spectroscopic studies carried at GANIL on Projectile-Fragments now include gamma, gamma-gamma, multi-particle, multi-neutron measurements in radioactive beta-decay. The data allow to test in detail theoretical models, in particular in the sd-shell. All proton-rich nuclei up to Z = 23 have now been identified and their decay investigated, at least partially. Two-proton radioactivity could not be observed in ^{22}Si, ^{31}Ar and ^{39}Ti. The new beta-delayed four-neutron radioactivity of ^{17}B and the ongoing search of other beta-delayed decay modes are reported.

45940 (LYCEN–89-02 S.17.1-S.17.6) **Study of Coulomb and dispersive effects by comparison of electron and positron scattering on nuclei.** Breton, V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Nucleaire a Haute Energie); Amroun, A.; Bricault, P.; Dreux, P.; Frois, B.; Goutte, D.; Phan, X.H.; Platchkov, S.K.; Cardman, L.C.; Linzey, A.; Offerman, E.Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies

session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

We have compared electron and positron elastic scattering cross sections on ^{208}Pb and ^{12}C for momentum transfer up to 2 fm^{-1}. These comparisons show that the corrections for Coulomb distorsions and dispersive effects, used in the analysis of electron scattering experiments, are accurate within 2%.

45941 (PCCF-T–89-03) **Experimental study of light fragment production, during the Ne + Nb reactions at 400 and 800 MeV per nucleon, applying Diogene detector.** Marroncle, J. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. May 1989. 177p. (In French). Order Number DE90514617. Source: NTIS (US Sales Only), PC A09/MF A01.

The topics of this thesis concern the comparison between experimental data issued from Diogene and theoretical predictions obtained by the Quantum Molecular Dynamics (QMD) model and the intra-nuclear cascad model, for the reaction Ne+Nb at 400 and 800 MeV per nucleon. We have developed an original process to form fragments from nucleons given by 1 body distributions from these models, which are introduced in Diogene's experimental filter to take into account the detector biases. These reactions are studied by QMD for two equations of state (Soft and hard) and for two samples of collisions (central and peripheral). Reactions are well described by QMD but the agreement would be better if we introduced the medium effects and MDI (Momentum Dependent Interaction) especially for peripheral collisions. Nevertheless the small statistic do not allow conclusion concerning the equation of state. The intra-nuclear model shows a good ability to reproduce experimental data in spite of transparency effects for central collisions.

45942 (UM-P–89/43) **Photoproton cross section for ^{17}O.** Zubanov, D. (Melbourne Univ., Parkville (Australia). School of Physics); Thompson, M.N.; Berman, B.L.; Jury, J.W.; Pywell, R.E.; McNeill, K.G. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 39p. Order Number DE90636389. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Prepared for submission to Phys. Rev., C.

The measurement of the $^{17}O(\gamma,p)^{16}N$ reaction from threshold to an excitation energy of 44 MeV is presented. These results have been summed with the previously measured total photoneutron cross section to provide an approximation to the total photoabsorption cross section of ^{17}O. The magnitude of the ^{17}O photoabsorption cross section at the peak of the Giant Dipole Resonance is considerably less than the equivalent value for the photoabsorption cross sections of ^{16}O and ^{18}O. In addition, the integrated total photoabsorption cross section for ^{17}O (up to 40 MeV) exhausts only about 58% of the sum rule; the values for the cases of ^{16}O and ^{18}O are significantly larger than this. The present data along with results from other reaction channels of this nucleus, were used to make spin, parity, and isospin assignments for several states in ^{17}O. 48 refs., 4 tabs., 7 figs.

6514 Nuclear Properties and Reactions, A = 20-38, Experimental

Refer also to citation(s) 45914, 45939, 45975

45943 (CEA-N–2620) **Low mass dimuon production in 200 GeV/c per nucleon sulphur ion collisions on heavy targets.** Vasseur, G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires; Paris-11 Univ., 91 - Orsay (France). Nov 1989. 234p. (In French). Order Number DE90514683. Source: NTIS (US Sales Only), PC A11/MF A01.

The HELIOS/2 experiment at CERN studies, among other features, low mass muon pairs production in 200 GeV/c per nucleon sulphur-nucleus interactions, compared to proton-nucleus interactions at the same energy. As muons interact weakly with nuclear matter, they provide relatively clean information on the initial state of these collisions. In addition, an anomalous production of low mass dileptons, with an unusual quadratic dependence upon multiplicity, could be a signature of quark-gluon plasma. To get the target produced dimuon signal, two sources of backgrounds have to be removed: the dimuon production in the dump and the pion and kaon decays into muons. After subtraction of these backgrounds, acceptance correction and normalization, a dimuon signal is obtained, especially at low mass. It is compatible with known sources of low mass dimuons: vector meson decays and Dalitz pairs. In proton-nucleus, this result is in contradiction with previous experiments. In sulphur-nucleus, no great effect giving evidence of quark-gluon plasma formation is observed.

45944 (JAERI-M–90-025, pp. 226-232) **Measurement of helium production cross section of aluminum irradiated by proton.** Takao, Yoshiyuki (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Kanda, Yukinori; Itadani, Sigeki; Takahashi, Tuyoshi; Eifuku, Hideki; Morinaga, Muneaki; Iwasaki, Akio. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The proton-induced helium production cross sections of aluminum have been measured using the Helium Atoms Measurement System. Eleven pieces of aluminum foil (chemical purity 99.999%, size 10 x 10 x 0.1mm^3) are prepared for samples. The samples are stacked and irradiated by 14MeV protons generated by a tandem accelerator. Helium production cross sections at several kinds of proton energy can be measured by using stacked samples at a time, because the proton energy is changed in the samples. (author).

45945 (JAERI-M–90-025, pp. 251-258) **Measurement of formation cross sections for short-lived nuclei produced by 14 MeV neutrons, 3.** Yamada, T. (Nagoya Univ. (Japan). Faculty of Engineering); Osa, A.; Shibata, M.; Kawade, K.; Yamamoto, H.; Katoh, T.; Iida, T.; Takahashi, A. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Neutron activation cross sections of short-lived nuclei with half-lives between 0.5 and 20 m have been measured at neutron energy of 13.4 to 14.9 MeV by the activation method for 14 reactions; $^{26}Mg(n,\alpha)$, (n, n'p), $^{28}Si(n,p)$, $^{30}Si(n,\alpha)$, (n, n'p), $^{37}Cl(n,p)$, $^{52}Cr(n,p)$, $^{53}Cr(n,p)$, (n, n'p), $^{66}Zn(n,p)$, $^{67}Zn(n,n'p)$, $^{68}Zn(n,p)^{m}$, and $^{113}In(n,2n)^{m,g}$. (author).

45946 (JAERI-M–90-025, pp. 259-267) **Measurement of production cross sections of short-lived nuclei by cyclic activation using a pulsed neutron source.** Yamamoto, Junji (Osaka Univ., Suita (Japan). Faculty of Engineering); Datemichi, Jun; Kanaoka, Takeshi; Takayama, Takuzo; Takahashi, Akito; Sumita, Kenji. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Cyclic activation using a pulsed neutron source is a very efficient technique to measure short-lived radioactivities. The technique has been utilized for the purpose of elemental analysis. In the present paper, the potentiality was discussed for application of this technique to the cross section measurements concerning the production of short-lived radioisotopes by neutron-induced reactions. An advanced system to measure energy spectra of emission γ-rays simultaneously with decays of the γ-rays was tested for the radioisotopes with half lives up to a few seconds. Some experimental results are presented with respect to the induced activities with half lives from 20.2 ms to 7.1 s. (author).

45947 (JAERI-M–90-025, pp. 277-283) **Average cross section measurement for several dosimetry reactions in thick target Li(d, n) neutron field.** Dumais, J.R. (Tohoku Univ., Sendai (Japan). Faculty of Engineering); Tanaka, S.; Odano, N.; Iwasaki, S.; Sugiyama, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear*

data. Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Average cross sections have been measured for several dosimetry reactions by means of activation method in thick target Li(d, n) neutron field which had continuous energy spectrum ranging from a few hundred KeV to 18 MeV. The aim of this study is to verify cross section data of the recently evaluated JENDL-3 and the IRDF-82 dosimetry files by comparison of the calculated average cross sections with the experimental ones. Standard deviations in both values were estimated on the basis of the variance-covariance analysis. Absolute value of the neutron flux was normalized at 14 MeV by measurement of the reaction rate of the $^{27}Al(n, \alpha)^{24}Na$ standard reaction in the T + d neutron field with the same arrangement. The results show that the calculated average cross sections using the above evaluated values are consistent with the experimental values, except for $^{58}Ni(n, 2n)^{57}Ni$ reaction. (author).

6515 Nuclear Properties and Reactions, A = 39-58, Experimental

Refer also to citation(s) 45937, 45939, 45941, 45945, 45947, 45953, 46206

45948 (CONF-900450–9) **Alpha-particle emission as a probe of nuclear shapes and structure effects in proton evaporation spectra.** Nicolis, N.G. (Washington Univ., St. Louis, MO (USA). Dept. of Chemistry); Sarantites, D.G.; Abenante, V.; Adler, L.A.; Dilmanian, F.A.; Majka, Z.; Semkow, T.M.; Stracener, D.W.; Baktash, C.; Beene, J.R.; Garcia-Bermudez, G.; Halbert, M.L.; Hensley, D.C.;.Oak Ridge National Lab., TN (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research; Joint Institute for Heavy Ion Research. DOE Contract AC05-84OR21400 ;FG02-88ER40406. From Nuclear structure in the '90's; Oak Ridge, TN (USA); 23-27 Apr 1990. Order Number DE90015787. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Emission barriers and subbarrier anisotropies from α decay of Sn* and Yb* compound nuclei are examined in the light of calculations incorporating deformation effects in the decay process. For the Yb* systems deformation which increases with spin is necessary to explain the data. For the Sn* systems the spectral shapes and anisotropies can be explained without deformation. For systems lighter than Sn this probe is not sensitive to the deformation. Energy spectra and angular correlations of evaporated protons from the $^{52}Cr(^{34}S, 2n2p)^{82}Sr$ reaction were measured in coincidence with discrete transitions. Large shifts in proton spectra were observed when high spin states in different rotational bands are populated. They are interpreted as due to near-yrast stretched proton emission preferentially populating the yrast band by subbarrier protons. Simulations show that channel selected proton spectra cannot be used as probes of deformation.

45949 (JAERI-M–90-025, pp. 216-225) **Nuclear data of charged-particle induced reactions on medium-heavy nuclei.** Watanabe, Y. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering); Koori, N.; Hyakutake, M.; Kumabe, I. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Measurements of double differential charged-particle emission cross sections are reported for proton-induced reactions on several medium-heavy nuclei in the bombarding proton energy range from 10 to 20 MeV. Some results of analyses based on preequilibrium models are summarized. (author).

45950 (JAERI-M–90-025, pp. 241-250) **Estimation of reaction model parameters by experimental data and statistical technique.** Kawano, T. (Kyushu Univ., Fukuoka (Japan)); Kanda, Y.; Uenohara, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Optical model parameters and level density parameters for Hauser-Feshbach model calculations are estimated systematically for $^{58,60}Ni$ and ^{59}Co by using Bayesian method. The experimental data for estimation are neutron induced reactions {total, (n,p), (n,α), and (n,2n) cross sections, and proton, α-particle emission spectra by 14.8 MeV neutron} and proton induced reactions {(p,n) and (p,α)}. The cross sections calculated with posterior parameters are improved compared with those calculated with prior ones. (author).

45951 (JAERI-M–90-025, pp. 393-402) **Neutron cross section calculation for ^{56}Fe and ^{235}U in the up to 50 MeV energy range.** Hida, K. (Toshiba Corp., Kawasaki, Kanagawa (Japan)); Iijima, S. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Neutron cross sections are calculated for ^{56}Fe and ^{235}U in the up to 50 MeV energy range. For ^{56}Fe, a comparison is made between ALICE and GNASH using the same calculational parameters. It was found that the difference becomes appreciable when many particle emissions dominate in the high energy region. Calculations are made for ^{235}U only with ALICE, because of its fission cross section calculation capability. Comparisons with experimental data are also given. (author).

6516 Nuclear Properties and Reactions, A = 59-89, Experimental

Refer also to citation(s) 45935, 45945, 45949, 45950, 45973

45952 (JAERI-M–90-025, pp. 53-68) **JENDL-3 FP data file.** Watanabe, T. (Japanese Nuclear Data Committee, Tokai, Ibaraki (Japan)); Kawai, M.; Iijima, S.; Matsunobu, H.; Nakagawa, T.; Nakajima, Y.; Sugi, T.; Sasaki, M.; Zukeran, A. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Evaluation work for JENDL-3 FP data file has been continued since 1985, and now evaluation work is on its final stage. In this paper, current status, contents of the file, evaluation methods, and discussion on evaluated data are briefly given. (author).

45953 (LBL–29143) **First in-beam γ-ray study of ^{67}As.** Lang, T.F.; Moltz, D.M.; Reiff, J.E.; Batchelder, J.C.; Ognibene, T.J.; Cerny, J.; Robertson, J.D.; Beausang, C.W.; Deleplanque, M.A.; Diamond, R.M.; Stephens, F.S. Lawrence Berkeley Lab., CA (USA). Jan 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8911216–1: Workshop on nuclear structure of light nuclei far from stability, Overnai (France), 27-29 Nov 1989). Order Number DE90015723. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Excited states of the neutron-deficient nucleus ^{67}As were populated using the $^{40}Ca(^{32}S,\alpha p)^{67}As$ and the $^{40}Ca(^{33}S,\alpha pn)^{67}As$ reactions at bombarding energies between 95 and 110 MeV. We present a tentative level scheme for ^{67}As, derived from γ-γ coincidence studies in conjunction with measurement of evaporated charged particles and neutrons.

45954 (LYCEN–89-02 S.18.1-S.18.16) **A microscopic description of low-energy collective dynamics of even even nuclei.** Deloncle, I. (Paris-11 Univ., 91 - Orsay (FR). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Bennour, L.; Libert, J.; Bencheikh, K.; Quentin, P.; Bencheikh, K.; Bennour, L.; Brack, M. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

We assess the solution of the Bohr Hamiltonian for the (triaxial) collective quadrupole dynamics of medium and heavy nuclei based on microscopic calculations starting from Skyrme type effective nucleon-nucleon interactions. The potential energy surfaces of

triaxial nuclei are evaluated nearly self-consistently by the expectation value method (EVM) based upon semiclassical extended Thomas-Fermi density variational calculations. The inertial tensors are obtained within a selfconsistent (Inglis) cranking model. Numerical results are presented for the nuclei ^{74}Ge and ^{110}Cd. For the latter nucleus, we demonstrate the good approximation provided by the EVM to the deformation energies obtained in fully self-consistent constrained Hartree-Fock calculations. The calculated low-energy collective spectra are found in good quantitative agreement with the experimental data.

45955 (NFL–60) **Delayed-neutron branching ratios of fission products: A status report.** Lund, E.; Rudstam, G. Uppsala Univ., Nykoeping (Sweden). Studsvik Neutron Research Lab. 1989. 21p. Order Number DE90636395. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Delayed-neutron branching ratios have been reviewed for 86 nuclides, including a few isomers, among the fission products. The list comprises values reported before the end of December, 1987. (authors) (33 refs.).

45956 (RCNP-P–108, pp. 14-19) **Nuclear structure of ^{87}Nb.** Min, B.J. (Kyushu Univ., Fukuoka (Japan). Faculty of Science); Suematsu, S.; Mukai, J.; Mitarai, S.; Kuroyanagi, T.; Heiguchi, K. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The reactions ^{58}Ni(^{32}S, 3p)^{87}Nb were used to populate excited states in ^{87}Nb. The deexcitation of these states was studied by in-beam γ-ray spectroscopy. Measurements of (p, α)-γ coincidence, p-γ γ coincidence and γ-ray angular distribution were performed. The level scheme of ^{87}Nb up to 6MeV in excitation energy was deduced. Spin and parity of ground state of ^{87}Nb were decided from the β-decay study of ^{87}Mo. The new decay scheme of ^{87}Mo was also deduced. (author).

45957 (RCNP-P–108, pp. 20-25) **(Pα n-γ γ) coincidence experiment of nuclei in the A = 80 region by means of NORDBALL and Si Ball.** Mitarai, S. (Kyushu Univ., Fukuoka (Japan)); Suematsu, S.; Min, B.J. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

NORDBALL experiment of the (^{58}Ni + ^{28}Si) reaction was carried out using additional instruments (Si Ball and Neutron Wall). The instruments detect particles evaporated from fusion reaction. The instruments showed high ability of selection for exit channels and high detection efficiencies for charged particles. (author).

6517 Nuclear Properties and Reactions, A = 90-149, Experimental

Refer also to citation(s) 45914, 45931, 45948, 45949, 45952, 45954, 45955

45958 (CONF-9008133–1) **Liquid drop effects in subbarrier transfer reactions.** Kim, H.J. Oak Ridge National Lab., TN (USA). Aug 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. Asia Pacific physics conference; Seoul (Republic of Korea); 13-17 Aug 1990. Order Number DE90015799. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Reaction products from a multitude of binary channels are observed to emerge at large c.m. angles at subbarrier energies for the ^{50}Ti + ^{93}Nb system. The energy spectra of these products and the distance where they first emerge indicate that these reaction products result from the neck which is formed outside the Coulomb barrier. 9 refs., 5 figs.

45959 (DOE/ER/40418–3) **Radioactive decay and nuclear structure studies: Progress report.** Walters, W.B. Maryland Univ., College Park, MD (USA). Dept. of Chemistry. 31 Jul 1990. 65p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER40418. Order Number DE90016501. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

In this report, new results are reported for the structures of ^{114}Te, ^{114}I, ^{116}Te, ^{119}Te, ^{121}Te, ^{129}Te, ^{119}Xe, ^{120}Xe, ^{126}Xe, ^{127}Xe, ^{136}I, ^{136}Xe, ^{145}La, and ^{147}Pr.

45960 (IPNO-DRE–89-22) **Valence and inner proton hole states in ^{119}In via the (d,^{3}He) reaction.** Langevin-Joliot, H. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Gerlic, E.; Guiliot, J.; Van de Wiele, J.; Van der Werf, S.Y.; Martens, T.H.; Schippers, J.M. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 26p. Order Number DE90514637. Source: NTIS (US Sales Only), PC A03/MF A01.

Proton hole states have been studied up to E_x = 17 MeV and E_x = 3.5 MeV in the ^{119}In nucleus via the ^{120}Sn (d,^{3}He)^{119}In reaction respectively at E_d = 108.4 MeV and E_d = 51 MeV. DWBA analysis of angular distributions has allowed l attributions for a large number of new levels and the determination of valence and inner hole strength distributions. The first $1g_{9/2}$, $2p_{1/2}$ and $2p_{3/2}$ levels only exhaust 40%, 60% and 32% of their respective sum rule limits. The missing strengths are shared among several low lying levels and significant higher lying contributions. The 1f strength, not identified in the previous experiments is spread from E_x = 1 MeV to about 17 MeV. The low lying levels around E_x = 2.4 MeV could exhaust some 40% of the $1f_{5/2}$ sum rule. The higher lying strength with a flat maximum around E_x = 7.5 MeV could account for the $1f_{7/2}$ inner hole strength and the missing $1f_{5/2}$ valence strength. The experimental strength functions compare rather well with the predictions of the quasiparticle-phonon model.

45961 (IPNO-DRE–89-27) **One nucleon transfer reactions induced by ^{20}Ne at 500 and 600 MeV.** Fortier, S. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Gales, S.; Austin, S.M.; Benenson, W.; Crawley, G.M.; Djalali, C.; Winfield, J.S.; Yoo, G. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 25p. Order Number DE90514638. Source: NTIS (US Sales Only), PC A03/MF A01.

The (^{20}Ne, ^{19}Ne), (^{20}Ne, ^{21}Ne) and (^{20}Ne, ^{21}Na) reactions on ^{90}Zr and ^{208}Pb have been investigated at 500 and 600 MeV incident energies. Experimental spectra have been compared with predictions of DWBA calculations. The different shapes observed for proton and neutron pick-up spectra are explained quite well by the calculations. In particular the second bump observed at about 6.5 MeV in the (^{20}Ne, ^{21}Ne) spectra is shown to originate from ejectile excitation in the 1d3/2, 1f7/2 and 2p3/2 orbitals. An important component of the (^{20}Ne, ^{19}Ne) cross section is due to three-body processes, such as the elastic break-up of ^{20}Ne into ^{19}Ne and one neutron. In addition, bumps are observed at about 1.5 and 10 MeV excitation energy in ^{209}Pb and 2.5 and 14 MeV in ^{91}Zr. The low energy peaks originate mainly from neutron transfer to high spin orbitals, i.e 1i11/2 and 1j15/2 in ^{209}Pb and 1g7/2 and 1h11/2 in ^{91}Zr. This is confirmed by DWBA calculations. Because of the selectivity of the (^{20}Ne, ^{19}Ne) reaction for large angular momentum transfer, it is proposed that the resonance-like structures observed at 14 MeV in ^{91}Zr and 10 MeV in ^{209}Pb are due to a neutron excitation in external high spin subshells, such as the 1i13/2 and 1k17/2 orbitals in the Zr and Pb nuclei, respectively.

45962 (IPNO-DRE–89-29) **Excitation of giant resonances in heavy ion reactions at intermediate energies. Results from the ^{40}Ar + ^{90}Zr and ^{208}Pb experiments at 41 MeV/u.** Suomijaervi, T. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Beaumel, D.; Blumenfeld, Y.; Chomaz, P.; Frascaria, N.; Garron, J.P.; Roynette, J.C.; Scarpaci, J.A.; Barrette, J.; Fernandez, B.; Gastebois, J.; Mittig, W. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 43p. Order Number DE90514722. Source: NTIS (US Sales Only), PC A03/MF A01.

Giant resonances in ^{90}Zr and ^{208}Pb have been studied by inelastic scattering of ^{40}Ar at 41 MeV/u. Strength distributions and exhausted sum rule values of different multipolarities are presented. The peak-to-background ratios and differential cross sections from inelastic scattering of heavy ions are compared to

those obtained with light projectiles. The influence of Coulomb interaction on the excitation of giant resonances and the possibility to study high multipole resonances by intermediate energy heavy ions are discussed.

45963 (LBL–29135) **Angular momentum in subbarrier fusion: isomer ratio measurements and a global analysis.** DiGregorio, D.E.; Lesko, K.T.; Harmon, B.A.; Norman, E.B.; Pouliot, J.; Sur, B.; Chan, Y.D.; Stokstad, R.G. Lawrence Berkeley Lab., CA (USA). May 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9005221–8: Interface between nuclear structure and heavy-ion reaction dynamics conference, Notre Dame, IN (USA), 24-26 May 1990). Order Number DE90015721. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have measured the ratio of the isomer to ground-state yields of ^{137}Ce produced in the fusion reactions ^{128}Te(^{12}C,3n), ^{133}Cs(^{7}Li,3n), ^{136}Ba(^{3}He,2n), ^{136}Ba(^{4}He,3n), and ^{137}Ba(^{3}He,3n), from energies above the Coulomb barrier to energies typically 20–30% below the barrier by observing the delayed x- and γ-ray emission. We deduce the average angular momentum, $\langle J \rangle$, from the measured isomer ratios with a statistical model. In the first three reactions we observe that the values of $\langle J \rangle$ exhibit the behavior predicted for low energies and the expected variation with the reduced mass of the entrance channel. We analyze these data and the associated cross sections with a barrier penetration model that includes the coupling of inelastic channels. Measurements of average angular momenta and cross sections made on other systems using the γ-multiplicity and fission-fragment angular correlation techniques are then analyzed in a similar way with this model. The discrepancies with theory for the γ-multiplicity data show correlations in cross section and angular momentum that suggest a valid model can be found. The measurements of angular momentum using the fission fragment angular correlation technique, however, do not appear reconcilable with the energy dependence of the cross sections. This systematic overview suggests, in particular, that our current understanding of the relationship of angular momentum and anisotropy in fission fragment angular correlations is incomplete. 26 refs.

45964 (LYCEN–89-02 C.3.1-C.3.12) **Shape evolution and superdeformation studies with the Chateau de Cristal.** Byrski, T. (Strasbourg-1 Univ., 67 (FR). Centre de Recherches Nucleaires). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The present status of the properties of the superdeformed structure is first introduced. Recent data are presented on the feeding of the superdeformed band in ^{149}Gd and on the yrast states of the odd-even nucleus ^{151}Tb, obtained with the Chateau de Cristal; in this last nucleus theoretical calculations clearly established shape changes correlated to single particle alignments at high spins. Data on a rotational band in ^{151}Tb characteristic of a superdeformed prolate shape are also presented; comparison with calculations of the observed variation in the $J^{(2)}$ moment of inertia with frequency, in ^{151}Tb and other known cases, suggest that the valence nucleons from the high-N intruder shells have a strong influence on the properties of superdeformed nuclei.

45965 (LYCEN–89-02 S.3-1) **Decay studies of very neutron-deficient nuclei near ^{100}Sn and ^{146}Gd.** Schardt, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (DE)). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Short note. NEUTRON-DEFICIENT ISOTOPES/beta decay; BETA DECAY/gamow-teller rules; BETA DECAY/tin 104; BETA DECAY/cadmium 100; BETA DECAY/erbium 150; BETA DECAY/ytterbium 152; BETA DECAY/erbium 151; BETA DECAY/dysprosium 149; ERBIUM 151/yrast states; DYSPROSIUM 149/yrast states

45966 (RCNP-P–108, pp. 26-28) **Low-lying states of ^{124}Cs.** Hosoda, T. (Tsukuba Univ., Ibaraki (Japan)); Komatsubara, T.; Heiguchi, K.; Kurniawan, I.; Nomura, T.; Aoki, T.; Furuno, K. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. CESIUM 124/excited states; CESIUM 124/carbon 12 reactions; YRAST STATES; FERMI LEVEL; INDIUM 115 TARGET; MEV RANGE 10-100; EXCITATION FUNCTIONS; GAMMA SPECTROSCOPY

45967 (RCNP-P–108, pp. 29-30) **High spin structure in the odd-odd nucleus ^{124}Cs.** Komatsubara, T. (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics); Hosoda, T.; Furuno, K. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

High spin states in the odd-odd nucleus ^{124}Cs have been investigated in the NORDBALL collaboration. Configuration of the yrast cascade could be determined as ($\pi h_{11/2} \times \nu h_{11/2}$) on the basis of blocking of both proton and neutron. In this band, large signature splitting of the B(M1)/B(E2) ratios have been observed. Furthermore, most significant feature of signature inversion could be expected in the lower spin part. (author).

45968 (RCNP-P–108, pp. 158-162) **High energy γ rays following the ^{92}Mo + ^{40}Ar reaction.** Yoshida, Koichi (Institute of Physical and Chemical Research, Wako, Saitama (Japan)); Kasagi, Jirota. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

High energy γ rays following the ^{92}Mo+^{40}Ar reaction at E/A=21,26 MeV have been measured with a large BaF_2 detector in coincidence with fusion residues. The obtained spectra consist of the high energy tails originating from the bremsstrahlung in the early stage of the reaction and the statistical decay of the excited residues with a strength function dominated by giant resonances. The obtained GDR yields are saturated above the excitation energy 260 MeV. (author).

6518 Nuclear Properties and Reactions, A = 150-189, Experimental

Refer also to citation(s) 45948, 45952, 45964

45969 (LYCEN–89-02 C.15.1-C.15.21) **Superdeformation in nuclei.** Sharpey-Schafer, J.F. (Liverpool Univ. (UK). Oliver Lodge Lab.). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

For the heaviest naturally occurring nuclei the nuclear and Coulomb forces are finely balanced, allowing the shell effects of deformation to play a crucial role in determining the nuclear stability. Thus, as actinide nuclei are deformed the increase in surface energy due to the nuclear forces is almost compensated for by the decrease in Coulomb energy as the protons get further apart. Oscillations in the shell corrections for actinide nuclei lead to the double-humped potential as a function of quadrupole deformation. The deformation of the second minimum in this potential is much larger than for normal nuclei and corresponds to a major to minor axis ratio of 2 to 1. States in this second minimum had been observed initially as spontaneously fissioning isomers by Polikanov et al. Excited states must exist in both the first and second minimum of the double-humped potential. Indeed, due to the deformation at

both minima, the nucleus is allowed to rotate about an axis perpendicular to the symmetry axis of the nucleus giving rise to rotational bands. These bands will have level separations governed by the moments of inertia I of the nucleus about the rotational axis. Clearly I increases with deformation and may be used as a measure of the shape at the second minimum if the levels in that minimum can be observed. The experimental difficulty with such observations is that in most reactions the second minimum is populated only very weakly, so that at best 1 in 10^5 fission events are delayed and from the decay of the fission isomer.

45970 (RCNP-P–108, pp. 105-106) **Search for double-γ vibrational states in deformed nuclei.** Oshima, Masumi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

We have been searching for double-γ vibrational states in deformed nuclei through multiple Coulomb excitation. Here we present a preliminary result for ^{164}Dy. (author).

45971 (RCNP-P–108, pp. 107-111) **Multiple Coulomb excitation of even-mass rare-earth nuclei.** Kusakari, H. (Chiba Univ. (Japan)). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The even-mass rare-earth nuclei of ^{164}Dy, ^{168}Er, ^{148}Nd and ^{150}Nd were multiple-Coulomb excited using the ^{58}Ni and ^{74}Ge beams from the JAERI tandem. Matrix elements of transitions between the ground-band members of these nuclei have been deduced, and they are discussed in comparison with the rotational values. (author).

45972 (RCNP-P–108, pp. 112-117) **Coulomb excitation experiment by NORDBALL.** Morikawa, Tsuneyasu (Hiroshima Univ. (Japan). Dept. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The Coulomb excitation experiment of ^{154}Sm was performed using 110MeV-^{32}S beams from the Tandem Accelerator at NBI, Denmark. The scattering chamber, in which five position sensitive detectors (PSD) and one annular detector are set, was combined with anti-compton spectrometer (ACS) array (NORDBALL) and about 10^7 particle-γ coincident events were accumulated. The γ-rays from 12_0^+ were observed. The data analysis is in progress. (author).

6519 Nuclear Properties and Reactions, A = 190-219, Experimental

Refer also to citation(s) 45936, 45940, 45961, 45962, 45997

45973 (BNL–44774) **Studies of central interactions of Si ions at 14.5 x A GeV/c in Au and Cu.** Eiseman, S.E. (Brookhaven National Lab., Upton, NY (USA)); Etkin, A.; Foley, K.J.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C.; Lindenbaum, S.J.; Chan, C.S.; Kramer, M.A.; Zhao, K.; Hallman, T.J.; Madansky, L.; BE-810 collaboration. Brookhaven National Lab., Upton, NY (USA); City Coll., New York, NY (USA); Johns Hopkins Univ., Baltimore, MD (USA); Rice Univ., Houston, TX (USA). [1990]. 21p. Sponsored by City University of New York; U.S. DOE Energy Research. DOE Contract AC02-76CH00016 ;AC02-83ER40107 ;AS05-81ER40032 ;AC (CONF-900822–6: 25. IUPAP international conference on high energy physics, Singapore (Singapore), 2-8 Aug 1990). Order Number DE90015095. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Understanding the growth and saturation of parametric instabilities in laser-produced plasmas requires knowledge of the nonlinear properties of the instabilities and their interaction with each other. Nonlinear behavior of parametric instabilities, which are usually associated with unique optical features, have been evidenced in numerous experiments on a variety of laser facilities. We will discuss four examples of nonlinear behavior in laser-produced plasmas: nonlinear stimulated Brillouin scattering spectra, suppression of stimulated Raman scattering by stimulated Brillouin scattering, the parametric decay instability and the onset of turbulence, and the transition to "bursting" behavior of the two-plasmon decay instability. We also discuss experiments that demonstrate the nonlinear effects which occur as a consequence. 49 refs.

45974 (BNL–44885) **Transverse energy and multiplicity distributions of p-p and A+A interactions.** Tannenbaum, M.J. E802 collaboration. Brookhaven National Lab., Upton, NY (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–3: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90015686. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Data from AGS-E802 have been presented at the percent HIPAGS workshop at BNL, published in journals and in conference proceedings (St. Malo, Moriond), to which the reader is referred. Two results are mentioned here. The Lead Glass distribution $dE_T^0/d\eta$ from central O + Au collisions can be compared to the spectrometer $dn(\pi-)/dy$ from central Si + Au collisions. The agreement of the two distributions is excellent and confirms that the estimated position and value of the maximum in the distribution $\eta|max$, $dE_T/d\eta|max$, and the width $\Delta\eta_{FWHM}$, from the PbGl data are reasonable, and that nothing exceptional is occurring outside of the PbGl acceptance. Additionally, these data, and previous measurements of pseudorapidity distributions of multiplicity and Transverse Energy at both the AGS and CERN are analyzed in an acceptance-independent and model-independent method, with the conclusion that simple considerations of nuclear geometry do not provide an explanation of the different $\sqrt{s}_{NN}$ dependences observed in ^{16}O + Au and p-p reactions. 13 refs., 2 figs.

45975 (BNL–44941) **Antiproton production in 14.6 A·GeV/c Si + A collisions.** Costales, J.B. (Massachusetts Inst. of Tech., Cambridge, MA (USA)). E802 Collaboration. Brookhaven National Lab., Upton, NY (USA). [1990]. 4p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration. DOE Contract AC02-76CH00016. (CONF-900570–4: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90016317. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Preliminary data are presented for the production of antiprotons and other charged particles produced in minimum bias and central Si + Al and Si + Au collisions measured using the E802 spectrometer at the Brookhaven Alternating Gradient Synchrotron. The antiproton data presented cover the range of transverse momentum from 0.3 to 1.2 GeV/c and lab rapidities from 0.9 to 1.7. The extracted rapidity densities, transverse mass slopes, and particle ratios from minimum bias and central Si + A collisions are compared to those measured in p + p and p + A collisions.

45976 (CRN/PN–89-17) **Study of the correlations between intermediate mass fragments in the ^{86}Kr + ^{197}Au reaction at 43 MeV/nucleon.** Glaser, M. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1989. 104p. (In French). Order Number DE90514623. Source: NTIS (US Sales Only), PC A06/MF A01.

The different reaction mechanisms occurring in the ^{86}Kr and ^{197}Au reaction, at 43 MeV/nucleon, are studied. The experiment is performed in an experimental device using, for the first time, three (among four) multidetectors available at Nautilus. The reaction crocs section is obtained. The investigation on the fragments coincidence allowed to show different components in the velocity correlation spectra. The reaction main characteristics are given. The simultaneous analysis of the quasi-projectile and the fragment(s), having intermediate velocities, showed the coexistence of different reaction mechanisms.

45977 (FRCEA-TH–278) **One-nucleon stripping reactions induced by heavy ions at incident energies of several tens of MeV per nucleon.** Tomasi-Gustafsson, E. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France). 1988. 154p. (In French). Order Number DE90514692. Source: NTIS (US Sales Only), PC A08/MF A01.

We have studied at the GANIL facility (Caen) the one-nucleon stripping reactions (^{12}C, ^{11}C) and (^{12}C, ^{11}B) on a ^{208}Pb target at an incident energy of 480 MeV. We have analysed the energy spectra up to 15 MeV excitation energy. The energy resolution obtained with the energy loss magnetic spectrometer SPEG was 200 keV FWHM. The comparison with similar reactions induced by ^{16}O on ^{208}Pb at 793 MeV gives experimental evidence of the population of the excited discrete levels in terms of two selection rules: (1) High spin states are selected; (2) the most populated states correspond to no spin-flip transitions. These rules are well understood in the semi-classical model of D.M. Brink, and are contained in the Exact Finite Range- Distorted Wave Born Approximation (EFR-DWBA) formalism. The EFR-DWBA calculations reproduce fairly well their shape, allowing us to extract spectroscopic factors in agreement with those previously known. EFR-DWBA calculations for ^{12}C induced reactions reproduce also the absolute values of the cross sections for all the analysed states, while for the reaction induced by ^{16}O the theory overestimates the experimental values by a factor of five to ten.

45978 (LBL–29160) **Superdeformed bands in ^{194}Tl.** Azaiez, F. (Lawrence Berkeley Lab., CA (USA)); Kelly, W.H.; Korten, W.; Deleplanque, M.A.; Stephens, F.S.; Diamond, R.M.; Beausang, C.W.; Draper, J.E.; Rubel, E.; Becker, J.A.; Henry, E.A.; Brinkman, M.J.; Yates, S.W.; Kuhnert, A. Lawrence Berkeley Lab., CA (USA). May 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-900450–7: Nuclear structure in the '90's, Oak Ridge, TN (USA), 23-27 Apr 1990). Order Number DE90015308. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Superdeformation was first observed in the mass-190 region in ^{191}Hg. Since then, SD bands have been found in $^{190-194}Hg$ nuclei. Here we report the discovery of two such bands in ^{194}Tl which are the first SD bands fond in this mass region that are not in Hg nuclei. Subsequently, bands have been found in two Pb nuclei. 5 refs., 1 fig.

45979 (LYCEN–89-02 S.11.1-S.11.8) **Intruder states in the Pb region.** Huyse, M.; Decrock, P.; Dendooven, P.; Reusen, G.; Van Duppen, P.; Wauters, J. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The fine structure in the α decay of mass-separated $^{194,196,198}Po$ is studied. Only feeding to the 0^+ groundstate and the first excited 0^+ intruder state in $^{190,192,194}Pb$ is observed. Out of the α-e-t coincidences between the feeding α and the EO transition, the half life of the 0^+ intruder state in $^{190,192,194}Pb$ is measured. The mixing between the intruder- and groundstate is deduced.

45980 (LYCEN–89-02 S.14.1-S.14.6) **Pb charge density: mean field and Lipkin-Nogami correlations.** Bennour, L. (Universite Libre de Bruxelles (BE). Service de Physique Nucleaire Theorique); Heenen, P.H.; Bonche, P.; Dobaczewski, J.; Flocard, H. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (In French). (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Charge densities of ^{208}Pb, ^{206}Pb and ^{205}Tl have been calculated to the HF + BCS approximation with Skyrme-like interactions. Correlations beyond mean-field are introduced using the Lipkin-Nogami method of approximate variation after projection on the good number of particles. Good agreement with the experimental data is obtained.

45981 (LYCEN–89-02 S.5.1-S.5.7) **Escape- and spreading width of the isobaric analog state.** Van Der Werf, S.Y. (Rijksuniversiteit Groningen (NL). Kernfysisch Versneller Inst.); Harakeh, M.N.; Jaenecke, J. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Data and systematics on the natural line width, the escape width and the spreading width of ground-state isobaric analog states (IAS) are presented. The relation between isospin impurity and spreading width and between escape width and spectroscopic factors is discussed.

45982 (UCRL-JC–103563) **Population of the superdeformed bands in the 190-mass region.** Brinkman, M.J. (Rutgers–the State Univ., New Brunswick, NJ (USA)); Cizewski, J.A.; Wang, T.F.; Henry, E.A.; Becker, J.A.; Roy, N.; Yates, S.W.; Kuhnert, A.; Beausang, C.W.; Stephens, F.S.; Diamond, R.M.; Deleplanque, M.A.; Korten, W.; Kelly, W.H.; Azaiez,Lawrence Livermore National Lab., CA (USA). 6 Jun 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9005221–7: Interface between nuclear structure and heavy-ion reaction dynamics conference, Notre Dame, IN (USA), 24-26 May 1990). Order Number DE90015204. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A strongly populated superdeformed band in ^{193}Hg, which is typical of superdeformed bands in the A $\sim$ 190 mass region, has been populated via two different reactions at a total of seven different energies. A preliminary analysis of the population of this band is presented.

6520 Nuclear Properties and Reactions, A = 220 and Above, Experimental

Refer also to citation(s) 45910, 45951, 45981

45983 (CEA-CONF–10030) **Present status of radiochemical double beta decay study (^{238}U).** Madic, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. de Genie Radioactif); Maillard, C.; Chevallier, A.; Chevallier, J.; Escoubes, B.; Schulz, N.; Sens, J.C. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1989. 7p. (CONF-8906160–: Yamada conference on nuclear weak processes and nuclear structure, Osaka (Japan), 12-15 Jun 1989). Order Number DE90514649. Source: NTIS (US Sales Only), PC A02/MF A01.

A sensitive experiment has been designed that will be able to measure an assumed half-life of $1.9x10^{22}$ yr. This double beta corresponds to the activity of 27000 ^{238}Pu nuclei formed during a year, in a 200 m deep mine, from 300 kg of ^{238}U, giving 210 alpha decays per year. Plutonium 238 et 239 will be determined by alpha spectroscopy after extraction chromatography. Experimental studies were undertaken to select the best conditions for running the extraction chromatography cycles.

45984 (INS–811) **Coordinate-dependent mass and the validity of the WKB approximation in fission barrier penetration calculations.** Kumar, K. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 10p. Order Number DE90513764. Source: NTIS (US Sales Only), PC A02/MF A01.

It is shown that the quasi-classical condition for the validity of the WKB approximation is satisfied although the mass associated with the spontaneous fission of ^{240}Pu varies by a factor of 12. A general numerical estimate of the allowed variations in such a mass is also given. (author).

45985 (JAERI-M–90-025, pp. 5-28) **Thermal reactor benchmark test of JENDL-3.** Iijima, Shungo (Toshiba Corp., Kawasaki, Kanagawa (Japan)). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Thermal reactor benchmark tests of JENDL were performed at JAERI for past several years using two different analysis methods, i.e., SRAC code system and MGCL+KENO-IV system. Tests were made with criticals of highly compact assemblies, low-enriched lattices and aqueous solutions of various concentrations fueled with ^{235}U, ^{239}Pu and ^{233}U. Results of tests are summarized. Main results of tests are: (1) For aqueous solutions of ^{235}U, ^{239}Pu and ^{233}U, JENDL-3 gives a better trend of K_{eff} versus fuel concentrations than JENDL-2, due to a harder fission spectrum adopted in JENDL-3. This is a strong support to JENDL-3. (2) However, SRAC results for ^{235}U systems are systematically low by about 1.5 %Δk while the results with MGCL+KENO-IV are in excellent agreement with experimental data. The method dependence must be clarified. For Pu systems of TCA lattices and nitrate aqueous solutions, both methods give consistent results and in good agreement with experimental data. (3) Lattice parameters of ^{235}U criticals are predicted well with JENDL-3 except that ρ_{28} is overestimated by 5 %. For PROTEUS compact Pu lattices, the lattice parameters are predicted within 5 % except for the F8/F9 of 50 % void case. For very compact $^{235}U/Th$, $^{233}U/Th/D_2O$ moderated ETA cores the lattice parameters are not calculated well. (author).

45986 (JAERI-M–90-025, pp. 29-52) **Review of JENDL-3 data from viewpoint for FBR benchmark tests.** Kikuchi, Yasuyuki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Results of FBR benchmark tests are reviewed. JENDL-3 predicts various FBR characteristics much better than JENDL-2. Particularly C/E values of sodium void coefficients and Doppler coefficients are much improved and space dependences observed with JENDL-2 for reaction rates, sodium void coefficients and control rod worth nearly disappear. On the other hand, it was pointed out that there exist a slight core dependence for effective multiplication factors and overestimation of threshold reaction rates. Concerning these points, the JENDL-3 data were reviewed by comparing the JENDL-2 data. Simultaneous evaluation was adopted for principal actinide nuclides. As a results, fission cross sections of ^{235}U and ^{239}Pu are lower than those of JENDL-2 below a few hundred keV. Lower capture cross section and higher inelastic scattering cross section were adopted for ^{238}U. A harder fission spectrum of Madland-Nix type was assumed. Considering the results of the benchmark tests and the characteristics of the JENDL-3 data. The following can be concluded. The balance of JENDL-3 is much better than that of JENDL-2. The low fission cross sections of ^{235}U and ^{239}Pu and the low capture cross section of ^{238}U seem to be reasonable. On the other hand, further study will be required for the inelastic scattering cross section of ^{238}U and the fission spectrum. (author).

45987 (JAERI-M–90-025, pp. 137-147) **Current topics in nuclear fission research.** Iwamoto, Akira (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

This year is the 50th anniversary of the discovery of nuclear fission by Otto Hahn and Fritz Strassmann. From the point of view of the fundamental physics research, nuclear fission was one of the oldest motivation of the nuclear physics. In this 50 years, many aspects of nuclear fission phenomena have been investigated. Owing to the nature that the nuclear fission involves a dynamical treatment of finite-many-body systems, there have been always some challenging new topics in nuclear fission research in these 50 years. By solving these problems one by one, we have come closer to the understanding of the nuclear fission dynamics. As examples of current topics in nuclear fission research, I will choose and discuss the following three: (1) Cold fission phenomena. (2) Heavy-particle radioactivity phenomena. (3) Transient effect phenomena. (author).

45988 (JAERI-M–90-025, pp. 343-361) **TRU transmutation with high energy proton beam.** Nishida, Takahiko (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takada, Hiroshi; Kanno, Ikuo; Takizuka, Takakazu; Mizumoto, Motoharu; Nakahara, Yasuaki; Kaneko, Yoshihiko. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data8.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Nuclear spallation reaction with high energy proton beam has been studied to be efficiently used for nuclear transmutation of the longlived nuclides generated in the spent fuel in the power reactor. In particular effective incineration of the transuranium nuclides (TRU) is able to be performed by this reaction. A national program called, OMEGA, has started aiming at promoting research and development of new technologies on nuclear waste partitioning and transmutation. JAERI has proposed the R and D plan for TRU transmutation by proton accelerators with the following items; (1) basic analysis of nuclear spallation and development of simulation code system, (2) design study of TRU transmutation plant, (3) spallation integral experiment and (4) development of an intensive high energy proton accelerator. In this paper we report the proceeding status of these research items, mainly about (1) and (2). (author).

45989 (JAERI-M–90-025, pp. 374-382) **Measurement of the U-238 capture cross section with neutron filtered beams.** Kobayashi, Katsuhei (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Yamamoto, Shuji; Fujita, Yoshiaki. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

By using the linac time-of-flight method and Fe and/or Si filtered neutrons of 24, 55 and 146 keV, the ^{238}U neutron capture cross sections were measured relative to the standard cross section for the $^{10}B(n, \alpha\gamma)$ reaction with a pair of C_6D_6 scintillator placed at the 12.4 m station. The measured value at 24 keV was normalized to 0.47 b appeared in the ENDF/B-VI file. The present data agree with the recent evaluations in ENDF/B-VI and JENDL-3 released very recently, and moreover with the recent measurement by Kazakov et al. The experimental uncertainties are 6 to 8 %, which are mainly derived from the counting statistics in the filtered neutrons. More careful works may be required in the data correction and uncertainty analysis for the present preliminary measurement. (author).

45990 (LYCEN–89-02 C.9-1) **Heavy elements research and the future at SIS.** Hofmann, S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (DE)). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Published in summary form only. HEAVY ION FUSION REACTIONS/element 107; HEAVY ION FUSION REACTIONS/element 108; HEAVY ION FUSION REACTIONS/element 109; ELEMENT 107/isotopes; ELEMENT 107/alpha decay; ELEMENT 108/isotopes; ELEMENT 108/alpha decay; ELEMENT 109/isotopes; ELEMENT 109/alpha decay; UNILAC/heavy ion fusion reactions; ISOTOPES; LIQUID DROP MODEL; UNILAC

45991 (LYCEN–89-02 S.4-1) **Mass, charge, and energy distributions of very asymetric ^{235}U (nth,f).** Sida, J.L. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Bernas, M.; Armbruster, P.; Bocquet, J.P.; Brissot, R.; Faust, H.R. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Short note. THERMAL FISSION/fission yield; THERMAL FISSION/pairing interactions; GRENOBLE REACTOR/uranium 235; GRENOBLE REACTOR/thermal fission

45992 (RCNP-P–108, pp. 163-166) **Spin distributions of fission fragments in the spontaneous fission of ^{252}Cf.** Kasagi, Jirota (Tokyo Inst. of Tech. (Japan). Faculty of Science). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Spin distributions of fission fragments in the spontaneous fission of ^{252}Cf were deduced from γ-γ coincidence measurements and from γ-ray multiplicity measurements. The obtained γ-ray multiplicity distribution clearly shows that the two fragments have almost same spin after the fission. (author).

45993 (RCNP-P–108, pp. 167-171) **Structure of spontaneous fission fragments of ^{252}Cf.** Kodama, Masakado (Tokyo Inst. of Tech. (Japan). Faculty of Science); Kasagi, Jirota; Furutaka, Kazuyoshi; Yoshida, Koichi; Gono, Yasuyuki. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. MOLYBDENUM ISOTOPES/fission fragments; MOLYBDENUM ISOTOPES/gamma spectroscopy; CALIFORNIUM 252; SPONTANEOUS FISSION; MULTIPLICITY; EXCITED STATES; SPIN; PARITY; EXPERIMENTAL DATA

45994 Harmonic analysis of stochastic descriptors and the interpretation of ^{252}Cf neutron source experiments. Difilippo, F.C. (Oak Ridge National Lab., TN (USA). Engineering Physics and Mathematics Div.). *Nuclear Science and Engineering (USA)*, 104(2): 123-134 (Feb 1990). DOE Contract AC05-84OR21400.

The harmonic expansion of the detector field of view in terms of direct and adjoint kinetic eigenfunctions together with the use of a modified version of the Schottky prescription of the equivalent source of noise make possible the harmonic analysis of stochastic descriptors used in the measurement of kinetic parameters. The results are general in the sense that they do not depend on the approximations of the Boltzmann operator, the distribution of fissile materials, or the multiplicity of the neutron source that drives the subcritical system. The results are applied to analyze the particular case of a system drive by a ^{252}Cf source, with the californium deposited in one of the electrodes of a fission chamber and monitored by two sets of neutron detectors. This analysis is oriented toward the interpretation of experiments to measure reactivities with the stochastic method of the ^{252}Cf source (ratio method). The theory is then used to synthesize stochastic observables using a simple approximation of the Boltzmann operator, i.e., two-point kinetics, which show the general features of the spatial effects observed experimentally.

6530 Nuclear Theory

Refer also to citation(s) 45821, 45846, 45848, 45850, 45891, 45892, 45895, 45911, 45934, 45942, 45948, 46114, 46118, 46203, 46328

45995 (BNL–44897) **Is there evidence for flow in heavy ion collisions?.** Von Gersdorff, H. Brookhaven National Lab., Upton, NY (USA). Jul 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900570–6: 8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90, Menton (France), 7-11 May 1990). Order Number DE90016324. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Calculations using a transverse hydrodynamical model with a phase transition in the equation of state are compared to recent heavy ion data. We argue that hydrodynamics alone cannot reproduce the low p_T part of the experimental spectrum. 6 refs., 2 figs.

45996 (CONF-900912–1) **Low-lying collective quadrupole strengths in even-even nuclei.** Raman, S. Oak Ridge National Lab., TN (USA). [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 8. international conference on atomic masses and fundamental constants; Jerusalem (Israel); 9-14 Sep 1990. Order Number DE90016048. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A simple ansatz that "nuclei not too near closed shells are as deformed as they can be within a single major shell" appears to quantitatively reproduce the quadrupole deformations of even-even nuclei. The energy-weighted sum of the low-lying E2 strengths is found to be remarkably regular in its overall behavior. 17 refs., 2 figs.

45997 (CONF-9005254–1) **Giant resonance decay.** Beene, J.R.; Bertrand, F.E. Oak Ridge National Lab., TN (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 3. international spring seminar on nuclear physics: understanding the variety of nuclear excitations; Ischia (Italy); 21-25 May 1990. Order Number DE90015161. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Decay studies of giant multipole resonances are discussed, emphasizing the role of Coulomb excitation with intermediate energy heavy ions, which can provide very large cross sections for both isoscalar and isovector resonances. We discuss measurement of the photon decay of one and two phonon giant resonances, reporting results where available. It is pointed out throughout the presentation that the use of E1 photons as a "tag" provides a means to observe weakly excited resonances that cannot be observed in the singles spectra. 30 refs., 16 figs., 1 tab.

45998 (CONF-9005255–1) **Alpha-particles as probes of nuclear shape and structure effects in proton evaporation spectra.** Sarantites, D.G. (Washington Univ., St. Louis, MO (USA)); Nicolis, N.G.; Abenante, V.; Majka, Z.; Semkow, T.M.; Baktash, C.; Beene, J.R.; Garcia-Bermudez, G.; Halbert, M.L.; Hensley, D.C.; Johnson, N.R.; Lee, I.Y.; McGowan, F.K.; Riley, M.A.; Virtanen, A.;Oak Ridge National Lab., TN (USA). 1990. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 25. Zakopane school of physics conference; Zakopane (Poland); 5-12 May 1990. Order Number DE90015174. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The emission barriers and subbarrier anisotropies in the alpha-particle decay with respect to the spin direction on Sn and rare earth compound nuclei are examined in the light of recent calculations incorporating deformation effects in the decay process. For the Sn systems the spectral shapes and anisotropies can be examined without involving deformation. For the rare earth systems deformation which increases with spin is necessary to explain the data. Energy spectra and angular correlations of evaporated protons from the ^{52}Cr (^{34}S, 2p2n)^{82}Sr reaction were measured in coincidence with discrete transitions. Large shifts in proton spectra were observed when high spin states in different rotational bands are populated. These effects cannot be explained by statistical model calculations that do not include explicitly nuclear structure effects in the deexcitation process. They are interpreted as due to near-yrast stretched proton emission, which preferentially populates the yrast band by subbarrier protons.

45999 (DOE/ER/40322–102) **Theoretical studies in nuclear reactions and nuclear structure: Progress report.** Banerjee, M.K. (Maryland Univ., College Park, MD (USA). Dept. of Physics). Maryland Univ., College Park, MD (USA). Dept. of Physics and Astronomy. Jul 1990. 74p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40322. Order Number DE90016202. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: hadronic structure; hadrons in nuclei; hot hadronic matter; relativistic nuclear physics and m-m interactions; and heavy ion dynamics and related processes. (LSP)

46000 (DOE/ER/40380–2, pp. 102-133) **Collective models in excited nuclei and excited baryons.** Arabadjis, C.J. (Univ. of Massachusetts, Amherst (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In

HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility. Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The author reviews the single-particle shell model of nuclei pointing out some of its successes and failures. Collective models are then introduced as a way to overcome the inadequacies of the shall model. Specifically, the geometric interpretation is compared to the group theoretical approach and resulting spectra are found to agree. The shell model is then applied to nucleons and problems are shown to occur. A collective model is subsequently suggested as a means to study excited baryon spectra. The phenomenon of parity doubling is discussed as a natural consequence of the model. The effect is observed in N* and Δ* spectra with the expected behavior of states with large angular momentum. 12 refs., 19 figs.

46001 (DOE/ER/40380–2, pp. 168-185) **Nuclear matter saturation in a U(1) ⊗ chiral model.** Lin, Wei (Indiana Univ., Bloomington, IN (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

The mean-field approximation in the U(1) ⊗ chiral model for nuclear matter maturation is reviewed. Results show that it cannot be the correct saturation mechanism. It is argued that in this chiral model, other than the fact the ω mass can depend on the density of nuclear matter, saturation is still quite like the Walecka picture. 16 refs., 3 figs.

46002 (DOE/ER/40380–2, pp. 197-204) **Many body approach to electron scattering.** Carrasco, R.C. (Universidad de Valencia (Spain)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

Many body techniques have proved to describe successfully different nuclear processes, e.g. pion and photon scattering, pionic atoms, etc. The technique is especially suitable for heavy nuclei, where the local density approximation can be used to apply the calculations in infinite nuclear matter to the whole nucleus. Good agreement with the experimental results is obtained in a wide range of energies and for different nuclei without introducing any free parameter. In this work the author explores the possibilities of this powerful approach. 4 refs.

46003 (DOE/ER/40427–05-N90) **Parity nonconservation and nuclear polarizabilities.** Haxton, W. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1990]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9002117–4: Workshop on parity violation in electron scattering, Pasadena, CA (USA), 22-24 Feb 1990). Order Number DE90016121. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The hadronic weak interaction contributes to parity nonconserving observables in semileptonic interactions. Weak nuclear polarizabilities are frequently important in such interactions. Some of the interesting physics is illustrated by ^{18}F, a nucleus that provides an important constraint on the neutral weak hadronic current. One observable where the nuclear polarizability is expected to dominate is the nuclear anapole moment. The long-range pion contribution to this weak radiative correction is explored for both nucleons and nuclei. Similar polarizabilities that arise for time-reversal-odd hadronic interactions that conserve or violate parity are discussed in connection with atomic electric dipole moments. 20 refs., 4 figs.

46004 (IC–90/85) **On anomalous damping in quark-gluon plasma.** Lebedev, V.V. (AN SSSR, Moscow (USSR). Inst. Teoreticheskoj Fiziki); Smilga, A.V. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 14p. Order Number DE90636357. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We explore the possibilities of experimental studying the anomalous damping of quark and gluon collective excitations in hot hadronic matter $\zeta_{q,g} \propto g^2 T \ln(1/g)$ calculated accurately in our recent work. We show that this studying involves serious difficulties. Resumming accurately all the relevant graphs we find that low frequency polarization operator of colourless currents does not depend on ζ. There may exist fine effects, however, involving some influence due to ζ which are in principle measurable. One of these effects is some increase of relaxation time which in relativistic plasma is not seen, unfortunately, in the leading order. For low density nonrelativistic plasma, however, the effect may be significant. (author). 16 refs, 6 figs.

46005 (INS–815) **Nuclear collective motions and self-consistent effective interactions.** Kinouchi, S.-I.; Sakamoto, H.; Kubo, T.; Kihsimoto, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1990. 11p. Order Number DE90513783. Source: NTIS (US Sales Only), PC A03/MF A01.

The present status of our research on self-consistent effective interactions is discussed. In order to satisfy the condition of nuclear self-consistency, the interactions are derived from an average single particle potential which may contain velocity-dependent terms. Importance of the self-consistent effective interactions is illustrated with some applications. (author).

46006 (IPNO-DRE–89-12) **Nuclei spin response in the polarized and unpolarized (p,p') and (d,d') scattering.** Morlet, M. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 13p. (In French). Order Number DE90514628. Source: NTIS (US Sales Only), PC A03/MF A01.

The general behavior of the nuclei response to the spin excitation in the (p,p') scattering is studied. Results obtained from (d,d') scattering are also discussed. A method for studying the function of the spin isoscalar response is proposed. Polarized and unpolarized beams are considered. It is shown that the nuclei spin excitation response is not yet well understood, mainly the topics involving: the spin force quenching at low energy excited states, its amplification in the quasi-elastic range, and the need of finite nuclei models. The Saturne polarized deuteron beam offers the possibility to answer these questions.

46007 (IPNO-TH–88-4) **Spin determination from the angular distributions of identical colliding nuclei.** Leclercq-Willain, Ch. (Universite Libre de Bruxelles (BE)); Da Silveira, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Feb 1988. 8p. Order Number DE90514630. Source: NTIS (US Sales Only), PC A02/MF A01.

We are concerned here with collisions involving two identical nuclei either in the entrance or in the exit channels (or in both) for which the angular dependence of the differential cross section is function of the phase difference between the forward and the backward reaction amplitudes. We propose a simple graphical method for obtaining the symmetrization procedure parameter directly from the measured angular distribution.

46008 (JAERI-M–90-025, pp. 115-136) **The optical potential for neutrons and charged particles.** Ohsawa, Takaaki (Kinki Univ., Higashi-Osaka, Osaka (Japan). Atomic Energy Research Inst.). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Problems and recent topics in the study on the nuclear optical model are described with particular reference to the application to nuclear data evaluation. This includes the following items: (a) Global optical potentials and their validity; (b) Regional optical potentials; (c) Nonlocal and equivalent local potentials; (d) Ambiguities in the optical potential parameters; (e) Application of dispersion relations; (f) Optical potentials for the calculation of the inelastic scattering cross section. (author).

46009 (KEK–89-12, pp. 141-144) **Photonuclear experiments with polarized photons.** Terasawa, Tatsuo (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Sep 1989. (CONF-8810498–:

Workshop on the experiments by polarized proton and electron beams, Tsukuba (Japan), 27-28 Oct 1988). In *Proceedings of the workshop on the experiments by polarized proton and electron beams.* Order Number DE90777829. Source: NTIS (US Sales Only), PC A11/MF A01.

Greater attention has been attracted to photonuclear reaction with polarized photons as a useful means of investigating nuclear properties detailedly. However, difficulties in obtaining highly polarized photons have limited the application of polarized photons to a few successful studies such as photodisintegration of the deuteron. Recent development of the continuous electron beam accelerator, as well as new techniques such as laser backward scattering, have led to the possibility of successful application of highly polarized monochromatic photons to more general nuclear studies. The (γ, p) reaction caused by linearly polarized photons is discussed on the basis of the interaction of the electromagnetic field, and the nuclear conversion current and magnetization density are discussed in terms of the independent particle shell model. The report then outlines the $^{12}C(\gamma, p)$ reaction by tagged polarized photons. Monochromatic polarized photons are obtained using a photon tagging facility. Observations of the analyzing power of the $^{12}C(\gamma, p)$ reaction with tagged polarized photons in the energy region from 41.2 to 93.0 MeV are presented and discussed. (N.K.).

46010 (LUND-MPH-90-01) **The high-spin structure of ^{158}Er - a theoretical study.** Bengtsson, Tord. Lund Univ. (Sweden). Dept. of Mathematical Physics. Jan 1990. 25p. Order Number DE90636347. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

To demonstrate the use of diabatic orbitals in high-spin calculations, the yrast structure of ^{158}Er is calculated and compared to experiment. A very satisfactory reproduction of the observed spectra is obtained form lowest spins through the collective bands up to band terminations. From results like this, a detailed understanding of the observed features emerge. In this case for example, the different alignment properties in negative parity bands can be understood as due to deformation differences and the existence of additional bands are predicted. Furthermore, the limitations of the cranked mean field approach can be investigated due to the high level of detail in this approach. (author).

46011 (LYCEN-89-02 C.10.1-C.10.23) **Tensor correlations and the electron scattering responses of the nucleus.** Orlandini, G. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172--: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Some considerations are made about nuclear observables which are sensitive to the tensor part of the NN potential. In particular we focus on the longitudinal and transverse electron scattering response functions. After a short review of the most recent calculations, we present the results of a model study suggesting that tensor correlations are responsible for spreading the strength from the quasi elastic peak towards higher energies. The effects on the two responses are different. The quenching in the peak region is smaller in the transverse channel and is compensated by the additional MEC and IC contributions.

46012 (LYCEN-89-02 C.6.1-C.6.14) **Microscope study of nuclear isomerism.** Flocard, H.C. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (In French). (CONF-8903172--: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

This document presents a work realized in a framework study of nuclear structure by microscopic methods. At this program, which has started since few years, collaborate the laboratories of CEA Saclay, IPN Lyon and Orsay, Lawrence Livermore National laboratory and the universities of Bordeaux and Brussels.

46013 (LYCEN-89-02 S.8.1-S.8.12) **Nuclear collective motion described by the moments of the Wigner distribution function.** Mikhailov, I.N. (Joint Inst. for Nuclear Research, Dubna (SU)). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172--: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

The method elaborated by a Dubna group of theorists is presented in which the collective motion is described by the dynamic equations for the nuclear integral characteristics. The macroscopic dynamics is formulated starting from the equations of the microscopic theory. This is done by taking the moments in the full phase space from the equation for the Wigner distribution function. A number of formal questions is discussed including the problem of the closure of equations of the motion for the integral characteristics. The theory is applied to the description of the shape of rotating nuclei and of the properties of giant resonances with multipolarities up to $\lambda = 4$.

46014 (PCCF-T-89-02) **Analysis of calorimetry in ultra relativistic heavy ion collisions at 200 GeV per nucleon.** Felgeyrolles, X. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. May 1989. 86p. (In French). Order Number DE90514635. Source: NTIS (US Sales Only), PC A05/MF A01.

We draw up in this thesis the statement of the calorimetry analysis in ultra relativistic heavy ion collisions at 200 GeV/A. NA38 experiment studies the production of dimuons correlated with neutral transverse energy flow detected by an electromagnetic calorimeter. J/Ψ suppression in central collisions could be a signature of the quark-gluon plasma (Q.G.P.). Characteristics and limits of the apparatus are briefly described. On the other hand, calorimetry measurements and analysis methods are studied in details and future developments are proposed.

46015 (RCNP-P-108, pp. 1-3) **Anharmonicity of the two-phonon states in ^{100}Ru, ^{102}Ru and ^{104}Ru by means of the selfconsistent-collective-coordinate method.** Aiba, Hirokazu (Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235--: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Anharmonicity of the two-phonon states in ^{100}Ru, ^{102}Ru and ^{104}Ru is investigated by means of the selfconsistent-collective-coordinate method. It is shown that the neutron-number dependence of the properties of the 0_2^+ states can be reproduced by renormalizing the coupling effect of the neutron pairing vibrations into the collective Hamiltonian for quadrupole vibrations. (author).

46016 (RCNP-P-108, pp. 4-7) **Microscopic analysis of low-excitation anharmonic quadrupole vibrations.** Yamada, Kazuya (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235--: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. VIBRATIONAL STATES/ nuclear deformation; VIBRATIONAL STATES/quadrupoles; QUADRUPOLES; NILSSON-MOTTELSON MODEL; COLLECTIVE MODEL; QUASIPARTICLE-PHONON MODEL; RANDOM PHASE APPROXIMATION; HARTREE-FOCK-BOGOLYUBOV THEORY; NEUTRONS; SAMARIUM 152

46017 (RCNP-P-108, pp. 8-13) **Effective charge for interacting bosons in N = 50-82 shell.** Nakada, Hitoshi (Juntendo Univ., Tokyo (Japan). School of Medicine). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235--: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The behavior of the boson effective charge of the IBM is investigated in the N = 50-82 shell, by using such parameters as to

reproduce the Sn isotopes. It is found that the influence of the non-degeneracy of the single particle orbits is reduced to a single factor, and that the difference of the structure of the d-bosons between determined from the TDA approach and from the sum rule within one major shell affects quite small. On the other hand, the experimental B(E2; $2_1^+ \rightarrow 0_1^+$) values of Sn isotopes are reproduced very well by this boson description. For the effective charge of neutrons, $e_\nu^{(E2)} \simeq 1.2$ e is adopted for the reproduction. In addition, it is pointed out that most observed 0_2^+ and 4_1^+ states of Sn isotopes has consistent B(E2) values with the interpretation as $N_d = 2$ states. (author).

46018 (RCNP-P–108, pp. 31-32) **Dynamical mechanism of onset of stochastic motion in the SCC method.** Iwasawa, Kazuo (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics); Hashimoto, Yukio; Marumori, Toshio; Sakata, Fumihiko. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. COLLECTIVE MODEL/stochastic processes; HARTREE-FOCK METHOD; TIME DEPENDENCE; NONLINEAR PROBLEMS; RESONANCE; CANONICAL TRANSFORMATIONS; COUPLING

46019 (RCNP-P–108, pp. 38-42) **Collective motion of highly-excited nuclei: Attenuation or narrowing.** Matsuo, Masayuki (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. COLLECTIVE MODEL/level widths; EXCITED STATES; EIGENVALUES; MATRIX ELEMENTS; CONFIGURATION MIXING; FLUCTUATIONS

46020 (RCNP-P–108, pp. 43-45) **Diabatic vs. adiabatic approach to shape coexistence: Simple model analysis.** Fukui, T. (Kyoto Univ. (Japan). Faculty of Science); Matsuyanagi, Kenichi; Matsuo, Masayuki. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. NUCLEAR DEFORMATION/diabatic approximation; NUCLEAR DEFORMATION/adiabatic approximation; LANDAU-ZENER FORMULA; QUASI PARTICLES; PAIRING INTERACTIONS; CRANKING MODEL; GENERATOR-COORDINATE METHOD; COLLECTIVE MODEL; PARITY

46021 (RCNP-P–108, pp. 46-51) **Nuclear Meissner effect in the number-projected constrained cranked HFB solution and the superdeformation.** Sugawara-Tanabe, Kazuko (Tokyo Univ. (Japan). Dept. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The super-deformed band in ^{132}Ce is reproduced in the frame of constrained cranked HFB calculation which shows that the superdeformed band is characterized by the coherent vanishing of the pairing gap. This vanishing gap is confirmed in the number projected solution after the variation. The angular momentum fluctuation does not exist in the angular momentum constrained self-consistent HFB calculation. (author).

46022 (RCNP-P–108, pp. 61-64) **E3 giant resonance formed on diabolic transformation rotating band.** Mizutori, Shoujirou (Kyoto Univ. (Japan). Faculty of Science); Matsuyanagi, Kenichi; Shimizu, Y.R. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. ROTATIONAL STATES/nuclear deformation; ROTATIONAL STATES/giant resonance; GIANT RESONANCE/rotational states; GIANT RESONANCE/e3-transitions; E3-TRANSITIONS; RANDOM PHASE APPROXIMATION; YRAST STATES; CRANKING MODEL; NILSSON-MOTTELSON MODEL; OCTUPOLES; EXCITATION; HARMONIC OSCILLATOR MODELS

46023 (RCNP-P–108, pp. 65-70) **Time dependent resonating Hartree-Bogoliubov theory: Res HB RPA in a quasi-particle basis.** Nishiyama, Seiya (Kochi Univ. (Japan). Faculty of Science); Fukutome, Hideo. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Very recently, we have developed a theory of excitations in superconducting Fermion systems with large quantum fluctuations that can be described by resonance of time dependent non-orthogonal Hartree-Bogoliubov (HB) wave functions with different correlation structures. We have derived a new kind of variation equation called the time dependent Resonating HB equation, in order to determine both the time dependent Resonating HB wave functions and coefficients of a superposition of the HB wave functions. Further we have got a new approximation for excitations from time dependent small fluctuations of the Resonating HB ground state, i.e., the Resonating HB RPA. The Res HB RPA equation is represented in a given single particle basis. It, however, has drawbacks that the constraints for the Res HB RPA amplitudes are not taken into account and the equation contains equations which are not independent. We shall derive another form of the Res HB RPA equation eliminating these drawbacks. The Res HB RPA gives a unified description of the vibrons and resonons and their interactions. (author).

46024 (RCNP-P–108, pp. 71-74) **Velocity-dependent potential and particle-rotation couplings.** Kinouchi, S.-I. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study); Kishimoto, T.; Kubo, T. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Particle-rotation couplings induced by velocity-dependent terms in the Nilsson plus pair field are investigated. Resulting moments of inertia are underestimated systematically to the experimental values. Some effects are missing in treating the pair field. (author).

46025 (RCNP-P–108, pp. 75-79) **A microscopic extension of particle-rotor model.** Okamoto, R. (Kyushu Inst. of Tech., Kitakyushu, Fukuoka (Japan)); Nakano, M. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The Hamiltonian of particle-rotor model is semi-microscopically derived from the Po+QQ+P_2 Hamiltonian. An effective representation of the Hamiltonian includes the vibration of deformed core, the coupling between rotation and vibration of the core, and the dynamical coupling between the core and the extra quasi-particles. Meaning of preliminary results of numerical solution is discussed. (author).

46026 (RCNP-P–108, pp. 80-82) **Collective rotational analysis by the selfconsistent-collective-coordinate method.** Marumori, Toshio (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics); Terasaki, Jun; Sakata, Fumihiko. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese).

(CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Published in summary form only. ROTATIONAL STATES/ collective model; ROTATIONAL STATES/erbium 164; NUCLEAR DEFORMATION; YRAST STATES; RANDOM PHASE APPROXIMATION; HARTREE-FOCK-BOGOLYUBOV THEORY; VARIATIONAL METHODS; HIGH SPIN STATES; MOMENT OF INERTIA

46027 (RCNP-P–108, pp. 88-93) **Octupole deformation and the spdf boson model.** Sugita, Michiaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

We discuss (1) the parity doubling in the higher spin states and (2) the super β band of the actinide nuclei within the framework of the spdf boson model. (author).

46028 (RCNP-P–108, pp. 94-97) **Electro-magnetic properties of heavy nuclei.** Otsuka, Takaharu (Tokyo Univ. (Japan). Dept. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Two topics of electro-magnetic properties of heavy nuclei are discussed. The first topic is the M1 excitation from well-deformed heavy nuclei, and the other is the sudden increase of the isotope shift as a function of N in going away from the closed shell. These problems are considered in terms of the particle-number projected (Nilsson-) BCS calculation. (author).

46029 (RCNP-P–108, pp. 98-102) **Spin-dependence of diabolic pair transfer in the band crossing region.** Hasegawa, M. (Fukuoka Dental Coll. (Japan)); Tazaki, S.; Muramatsu, K. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

We investigate the characteristic behavior of the pair transfer matrix element by the particle-rotor coupling model instead of the usual HFB cranking model. The matrix element displays a kind of back-bending with increasing rotational frequency ω in the improved treatment of the band crossing. The dependence on spin I still gives a sudden change of the sign. This work was published in ref.8. (author).

46030 (RCNP-P–108, pp. 103-104) **Structure of rotational bands in odd-mass tin isotopes.** Iwasaki, Saburo (Chiba Univ. (Japan)). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Rotational bands in odd-mass tin isotopes are analyzed using an angular momentum projection method. Deformations (ϵ_2, ...) at the minima of J-projected energy surfaces are almost same to those for neighboring even-even nuclei. The agreement with experimental data is reasonably good. (author).

46031 (RCNP-P–108, pp. 118-123) **Moment of inertia and the interacting boson model.** Yoshida, N. (Tokyo Univ. (Japan). Faculty of Science); Sagawa, H.; Otsuka, T.; Arima, A. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Mass-number dependence of the moment of inertia is studied in relation with the boson number in the SU(3) limit of the interacting boson model 1 (IBM-1). The analytic formula in the limit indicates the pairing correlation between nucleons is directly related to the moment of inertia in the IBM. It is shown in general that the kink of the moment of inertia coincides with the maximum boson number of each element. (author).

46032 (RCNP-P–108, pp. 124-125) **Shell-filling dependent effects of triaxiality on properties of rotating odd-A nuclei.** Matsuzaki, M. (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

An analytic explanation of the shell-filling dependent behavior of B(E2) and the signature inversion is made based on the cranking picture. (author).

46033 (RCNP-P–108, pp. 126-132) **Signature-dependence of energy spectra, M1- and E2-transitions produced by γ-vibration.** Shimano, Takafumi (Tokyo Inst. of Tech. (Japan). Dept. of Physics); Ikeda, Akitsu. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The signature-dependence of the energy spectra, M1- and E2-transitions of proton $h_{11/2}$ rotational bands of ^{155,157}Ho, ^{159}Tm, ^{161,163,165}Lu is studied by a model of particles plus a symmetric rotor with the γ-vibrational degree of freedom. By using such a set of moments of inertia that the largest one is around the shortest axis, the signature inversion observed in these isotopes are reproduced. We have calculated M1- and E2-transition strengths with the obtained wave functions. All the characteristic features of the available experimental data are found to be well reproduced. (author).

46034 (RCNP-P–108, pp. 133-138) **Signature dependence of energy levels and highly-excited γ-bands.** Tajima, Naoki (Tokyo Univ. (Japan). Coll. of General Education). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

The effects of the rotation-alignment of a pair of neutrons on the signature splitting of the energy levels in ^{157}Ho are investigated in the framework of a proton-neutron-triaxial-rotor model. Configurations in which many quasi-particles are excited and highly-excited ($K \geq 4$) γ-band states are included in the model apace. In the model, if the full $(h_{11/2})^n(i_{13/2})^m$(n=1,2,3,...,11, m=0,2,4,...,12) configurations are coupled to a triaxial rotor, the resulting dimension of the hamiltonian becomes intractable. Our conclusions are summarized as follows: (1) The effect of the proton-neutron interaction (we assumed QQ attraction) is not enough strong to cause the signature inversion, which agrees with the conclusion of Hamamoto. (2) The effect of the coupling with highly excited γ-bands ($K \geq 4$) is negligible, at least when a triaxial rotor model with γ_0 = 15deg is employed. (3) The calculated energy levels suggest that the moment of inertia of a system composed of $h_{11/2}$ protons and $i_{13/2}$ neutrons has a γ-dependence similar to that of the irrotational flow, which dependence is usually assumed in the collective model. On account of the large angular momenta of the intruder orbitals, their moment of inertia is larger than that of the core. Hence, even when we exchange the moment of inertia of the 1-axis and that of the 2-axis for each other in an artificial way (γ-reversed moment of inertia), as Ikeda and Shimano did, the total system (=the nucleus)

still rotates around its intermediate-length axis, not around the shortest axis: The positive-γ rotation does not occur, and the signature inversion can not be reproduced. (J.P.N.).

46035 (RCNP-P–108, pp. 139-150) **High-spin states in the odd-A and the odd-odd nuclei based on the constrained Hartree-Fock-Bogoliubov approximation.** Tanabe, Kosai (Saitama Univ., Urawa (Japan). Coll. of Liberal Arts). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy*. Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

To analyze the microscopic structure of nuclear states in the non-yrast rotational bands for the odd mass and the odd-odd nuclei, the particle number- and the angular momentum-constrained Hartree-Fock-Bogoliubov (CHFB) calculation is extensively applied to the states containing unpaired nucleons in the blocked levels. Some preliminary results are reported for several rotational bands in the odd mass nuclei ^{159}Er, ^{163,165}Yb and the odd-odd nuclei ^{132}La, ^{134}Pr and ^{136}Pm. (author).

46036 (UKNDC(89)-P–116) **U.K. nuclear data progress report: January - December 1988.** Sene, M.R.; Cookson, J.A. (eds.). UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div. Mar 1990. 70p. (NEANDC(E)–302;INDC(UK)–044/LN). Order Number DE90636343. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

This report reviews current nuclear data from a variety of sources undertaking nuclear physics research, including Harwell Laboratory, the National Physical Laboratory and the Nuclear Physics Laboratory at the University of Oxford. It also covers work on nuclear chemistry. (UK).

46037 (UM-P–89/57) **Deformation and spin 1 effects in p-^{13}C scattering.** Amos, K.; Raynal, J. Melbourne Univ., Parkville (Australia). School of Physics. [1989]. 12p. Order Number DE90636362. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Also published in Aust. J. Phys. v. 42(6) p. 591-596.

Elastic scattering measurables for 547 MeV proton scattering from ^{13}C are calculated using a non-relativistic optical model potential in which deformation of the conventional Woods-Saxon forms of the real and imaginary central potentials is allowed as well as incorporating spin 1 transfer contributions. The latter are estimated from folding a simple two nucleon t-matrix with a Op-shell model wave function. 10 refs., 4 figs.

46038 (UM-P–89/76) **Which potentials have to be surface peaked to reproduce large angle proton scattering at high energy?.** Raynal, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)). Melbourne Univ., Parkville (Australia). School of Physics. 1989. 12p. Order Number DE90636363. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Submitted to Aust. J. Phys.

Corrections to the usual form-factors of the optical potential are studied in view to get a better fit for proton elastic scattering at large angles on ^{40}Ca at 497 and 800 MeV. When a real surface form-factor is added to the central potential in the Schroedinger formalism, the experimental data are as well reproduced as in the standard Dirac formalism. Coupling to the strong 3^- collective state gives a better fit. The use of surface corrections to the imaginary Dirac potential also gives improved results. A slightly better fit is obtained by the coupling to the 3^- state with, at the same time, a weakening of these corrections. Further corrections to the potential do not give significant improvements. 17 refs., 2 figs., 2 tabs.

46039 (UM-P–89/85) **On the algebraic scattering theory for heavy ions.** Amos, K. (Melbourne Univ., Parkville (Australia). School of Physics); Kiedeldey, H.; Morrison, I.; Allen, L.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 14p. Order Number DE90636364. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Algebraic potentials from SO(3,1) and SO(3,2) representations of scattering functions are deduced by matching to scattering functions obtained by fitting ^{12}C-^{12}C elastic scattering differential cross-sections. Their variations with energy suggest a simple mapping between algebraic and coordinate space interactions. 13 refs., 5 figs., 2 tabs.

46040 **Ultrahigh-energy photonuclear cross sections.** Gandhi, R. (Department of Physics, University of Arizona, Tucson, Arizona 85721 (USA)); Sarcevic, I.; Burrows, A.; Durand, L.; Pi, H. *Physical Review, D (Particles Fields) (USA)*, 42(1): 263-267 (1 Jul 1990). DOE Contract FG02-85ER40213.

We present results of calculations of the total inelastic photon-air cross sections at ultrahigh energies (up to 10^8 GeV in the laboratory) of relevance to on-going cosmic-ray experiments. The calculations take into account the high-energy QCD structure of the photon and are performed for a variety of photon and proton structure functions. The total inelastic photon-air cross section is obtained from the photon-proton jet cross section via an eikonalization procedure using a QCD-based diffractive model. The results are discussed in the context of the apparent excess muon content of air showers associated with point sources.

46041 **Pseudospin symmetry and quantized alignment in nuclei.** Stephens, F.S. (Nuclear Science Division, Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, CA (USA)); Deleplanque, M.A.; Draper, J.E.; Diamond, R.M.; Macchiavelli, A.O.; Beausang, C.W.; Korten, W.; Kelly, W.H.; Azaiez, F.; Becker, J.A.; Henry, E.A *Physical Review Letters (USA)*, 65(3): 301-304 (16 Jul 1990). DOE Contract AC03-76SF00098 ;W-7405-ENG-48.

Nine superdeformed bands in several nuclei of the mass-190 region all have transitions of the same or equivalent energies to within an average of about 1 keV–almost identical. Furthermore, it is found that transitions of the same energy do not always connect levels of the same spin, indicating noncollective angular momentum alignments that are all very nearly integers (0, 1$\hbar$, or 2$\hbar$). Possible explanations involving pseudospin are discussed.

6540 Radiation and Shielding Physics

Refer also to citation(s) 43914, 43928, 44280, 44977, 45156, 45176, 46065, 46203

46042 (ENEA-RT-FUS–89-20) **A possible mechanism for neutron emission from deuterium trapped in metals.** Segre, S.E.; Atzeni, S.; Briguglio, S.; Romanelli, F. ENEA, Frascati (Italy). Centro Ricerche Energia. Sep 1989. 7p. (CONF-8909356–2: Understanding of cold fusion phenomena, Varenna (Italy), 15 Sep 1989). Order Number DE90514504. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the workshop on understanding of cold fusion phenomena (Varenna, 15-16 Sep 1989).

A mechanism for neutron emission from deuterated metals is proposed, which is proposed, which is based on some known phenomena, concerning hydrogen precipitation in cavities within supersaturated metals. Furthermore, it is assumed that in the fracturing of the deuterium-filled cavities, electric fields of sufficient intensity and duration are created, which produce energetic deuterons and, hence, neutrons from D(d,n) ^{3}He reactions. The mechanism predicts neutron yields compatible with those reported in some of the experiments and implies a certain degree of experimental irreproducibility.

46043 (ETDE-IT–90-20) **Interpretation of the Euracos iron and sodium benchmarks.** Perlini, G.; Rief, H.; Vittone, E.; Burn, K.W. ENEA, Bologna (Italy). Sep 1988. 6p. (CONF-880906–14: 7. international conference on radiation shielding, Bournemouth (UK), 12-16 Sep 1988). Order Number DE90514496. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 7th international conference on radiation shielding (Bournemouth, 12-16 Sep 1988).

The EURACOS installation (Enriched URAnium COnverter Source) consists of a circular fission source of 80 cm diameter placed in an irradiation chamber of a 150x150 square centimeter cross section and 400 cm length. The source is made of a U-Al alloy with 90% enriched U235. Within the framework of studies on

deep penetration of neutrons in shielding materials, the propagation of fission neutrons in large iron and sodium benchmarks was measured using sulphur, indium and gold activation detectors. The propagation was also calculated by the Monte Carlo code MCNP in conjuction with a surface-splitting procedure developed by A. Dubi. Nuclear point-cross-section data were taken either from ENDF/B4 or from JEF1. Agreement of calculations with measurments was generally good. The analysis evidenced that in the high energy range, which is of dominant importance in shielding calculations, one can trust the existing cross-section libraries, as well as the deep-penetration calculational methods applied. In the lower energy range, where non negligible discrepancies showed up, improvements to cross section libraries are necessary.

46044 (ETDE-IT–90-26) **Developments in the direct statistical approach to Monte Carlo optimization.** Burn, K.W.; Dubi, A.; Goldfeld, A.; Tinti, R. ENEA, Bologna (Italy). Dipt. Reattori Veloci. Sep 1988. 15p. (CONF-880906–15: 7. international conference on radiation shielding, Bournemouth (UK), 12-16 Sep 1988). Order Number DE90514501. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the 7th international conference on radiation shielding (Bournemouth, 12-16 Sep 1988).

Current aspects and future developments of the Direct Statistical Approach to the optimization of splitting in Monte Carlo are dealt with. This paper is divided into two parts. The first part deals with the critical point in the implementation where the infinite second moment and time series are truncated. The current status and improvements of the NIOP neutron transport codes are considered. The second part deals with an extension of the DSA theory to cover natural volumetric bifurcation problems by focusing on gamma production from neutron collisions.

46045 (JAERI-M–90-025, pp. 284-294) **The measurement of leakage neutron spectra from various sphere piles with 14MeV neutrons: Al, Mo and W.** Ichihara, Chihiro (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Hayashi, S.A.; Kobayashi, Katsuhei; Kimura, Itsuro; Yamamoto, Junji; Takahashi, Akito. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

In order to perform the benchmark test of the newly compiled JENDL-3 nuclear data file, neutron leakage spectra from three kinds of materials were measured. The results were compared with the calculations using MCNP Monte Carlo code and pointwise cross section library processed from JENDL-3T and other data files, ENDF/B-IV, ENDL-85. Measured samples were aluminum, molybdenum and tungsten. The experiments were performed by using an intense 14 MeV pulsed neutrons and a time-of-flight (TOF) technique in the energy range between 100 keV and 15 MeV. (author).

46046 (JAERI-M–90-025, pp. 313-328) **Analysis of neutron benchmark experiments to evaluate the JENDL-3 by the continuous energy Monte Carlo Code.** Ueki, K. (Ship Research Inst., Tokyo (Japan)); Sakurai, K.; Kawai, M. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The pointwise cross sections on which the JENDL-3 nuclear data library was based were prepared by using the NJOY-83 and the MACROS code system to analyze neutron shielding experiment by the continuous energy Monte Carlo Code MCNP. To evaluate the iron cross sections in the JENDL-3, the ORNL and the WINFRITH iron neutron shielding benchmark experiments were selected to the present purpose. Those two benchmark experiments have not only the reaction rates or the detector responses but also the neutron energy spectra covering a wide energy region. The Monte Carlo MCNP calculations were carried out with the pointwise cross-sections from the ENDF/B-IV as well as the JENDL-3. The reliability of the iron cross sections in the JENDL-3 were evaluated through the comparisons and the discussions of the calculated results with experiments. (author).

46047 (JAERI-M–90-025, pp. 329-342) **Development of the JENDL special purpose data file for PKA spectra, DPA cross sections and kerma factors.** Iijima, Shungo (Toshiba Corp., Kawasaki, Kanagawa (Japan)); Kawai, Masayoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Method of calculation of the neutron-induced primary knock-on atom spectra, atom displacement cross sections and kerma factors is presented based on the nuclear data from the evaluated data file of ENDF/B-5 format, supplementing the emitted charged particle spectra from nuclear cross section calculation code. Approximate and compact formulas of DPA cross section and kerma factor were derived for the reaction sum involving multi-particle emissions. The formulas are valid for medium and heavy mass nuclei. Examples of calculation on iron are given for neutron energies up to 40 MeV. Comparison was made with the kerma factor calculated by Howerton and Caswell et al. below 20 MeV and the DPA cross section with RADHEAT-V4 and TENJIN-2 code below 15 MeV. It is shown that the high energy kerma factor is governed by the charged particle emission, while the high energy DPA cross section is mainly determined from neutron optical potential. (author).

46048 (JAERI-M–90-041) **PALLAS-1D(V3): variable-dimension version of PALLAS-1D(VII).** Takeuchi, Kiyoshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Tanaka, Shun-ichi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 50p. Order Number DE90513756. Source: NTIS (US Sales Only), PC A03/MF A01.

The PALLAS-1D(V3) program is a variable-dimension version of the PALLAS-1D(VII) code, which is the revised version of the PALLAS-PL, SP-Br code. The PALLAS-1D(VII) code could treat transport of both neutrons and gamma rays, in particular of secondary photons including the bremsstrahlung and annihilation photons. This document gives a full description of input and output data for PALLAS-1D(V3) code, also with the input description of several sample problems. (author).

46049 (PINSTECH/RIAD–120) **Shielding calculations for the design of neutron radiography facility around PARR.** Ashraf, M.M.; Khan, A.R. Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Radiation and Isotope Application Div. Jun 1989. 36p. Order Number DE90636330. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Shielding calculations for neutron radiography facility, proposed to be established around PARR have been carried out using two group diffusion theory and shielding formulae. Gamma radiation penetration calculations have been carried out using simple attenuation methods. The fabrication and installation of the neutron radiography facility would provide the basis for designing a better collimating system and would help establish under water radiography facility for the inspection of highly radioactive materials and components etc. (orig./A.B.).

46050 (UCRL–102786) **The All Particle Monte Carlo Method: 1990 Status Report.** Rathkopf, J.A.; Ballinger, C.T.; Cullen, D.E.; Perkins, S.T.; Plechaty, E.F. Lawrence Livermore National Lab., CA (USA). 30 Jul 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900970–2: International conference on Monte Carlo methods in neutron and photon transport, Budapest (Hungary), 25-28 Sep 1990). Order Number DE90015608. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of the All Particle Method, a project to simulate the transport of particles via the Monte Carlo method, has proceeded on two fronts: data collection and algorithm development. In this paper we report on the status of both these aspects. The data collection is nearly complete with the addition of electron and atomic data libraries and a newly revised photon library to the existing neutron and charged particle libraries. We describe the basic organization of the Monte carlo computer code that will actually perform the simulation. Algorithm development has proceeded less quickly than the data portion of the project. the new Response Matrix

Monte Carlo method is summarized and some numerical results presented.

6550 Medical Physics

Refer also to citation(s) 45325, 45582

46051 (INIS-XN–253) **Occupational dose control in Nuclear Power Plants: An Overview.** Viktorsson, C.; Lochard, J.; Beneditini, M.; Baum, J.; Khan, T.A. Nuclear Energy Agency, 75 - Paris (France). 1990. 34p. Order Number DE90636828. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Reduction in occupational exposure at nuclear power plants is desirable not only in the interest of the health and safety of plant personnel, but also because it enhances the safety and reliability of the plants. This report summarises the current trends of doses to workers at nuclear power plants and the achievements and developments regarding methods for their reduction.

46052 (IPSM–53) **Patient dosimetry techniques in diagnostic radiology.** Wall, B.F. (National Radiological Protection Board, Chilton (UK)); Harrison, R.M.; Spiers, F.W. Institute of Physical Sciences in Medicine, London (UK). 1988. 117p. Source: Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. (Price Pound 16.50).

This booklet has been prepared as a practical manual for hospital physicists who are required to measure the radiation doses received by patients during diagnostic x-ray examinations. An attempt has been made to bring together in one volume advice on dose quantities, measurement strategy and suitable dosimetric techniques for use in a variety of clinical situations. A review is included of the physical data that are needed to relate doses measured externally to the patient to the internal doses that are more useful for assessing radiation hazards. (author).

46053 (PNL-SA–17693) **Photon backscatter measurements of the polymethylmethacrylate phantom used in the US personnel dosimeter accreditation programs (NVLAP, DOELAP).** Large, K.K.; Hooker, C.D.; McDonald, J.C.; Traub, R.J. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 16p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. (CONF-900679–6: 1990 Health Physics Society meeting, Anaheim, CA (USA), 24-28 Jun 1990). Order Number DE90015302. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A study was conducted to determine the photon backscatter contribution to the response of thermoluminescent dosimeters (TLDs) that are irradiated on polymethylmethacrylate (PMMA) phantoms. Because the dose equivalent for photons is computed from the product of the exposure, the exposure to dose conversion factor, the backscatter factor, and the quality factor, it is necessary to know the backscatter factor to evaluate the dose equivalent. The backscatter factor was determined for the photon beams used in proficiency test irradiations. X-ray beams with effective energies ranging from approximately 15 to 120 keV were used along with Cs-137 and Co-60 gamma-rays. Thin LiF dosimeters were exposed in air and on the PMMA phantom, and the ratio of their responses per unit exposure were taken as a measure of the backscatter factor. These data were then compared with a previous set of Monte Carlo computer calculations, and were used to compute exposure to dose equivalent (C_x) factors that were compared with the C_x factors used for the DOELAP and NVLAP programs. The results of these measurements will be described in this presentation. 21 refs., 4 figs.

46054 (SAND–90-0189C) **Effect of ENDF/B-VI cross sections on neutron dosimetry.** Griffin, P.J.; Kelly, J.G.; Luera, T.F. Sandia National Labs., Albuquerque, NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900814–9: 7. ASTM-EURATOM symposium on reactor dosimetry, Strasbourg (France), 27-31 Aug 1990). Order Number DE90016217. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

ENDF/B-VI cross sections were released to the testing community in January 1990. Work at Sandia National Laboratories, with pre-released versions of the new cross sections indicates that changes in the neutron-induced charged-particle reactions will significantly affect 14-MeV neutron dosimetry. Reactions that are important for fission reactor dosimetry were examined and most did not change significantly. 12 refs., 3 figs., 3 tabs.

6560 Condensed Matter Physics

Refer also to citation(s) 44137, 44620, 44625, 44638, 44784, 44786, 44823, 45129, 45136, 45139, 45164, 45519, 45909, 46050, 46087, 46129, 46130, 46270

46055 (BNL–44963) **Light scattering from surface and subsurface defects.** Church, E.L. (Army Armament Research and Development Command, Dover, NJ (USA)); Takacs, P.Z. Brookhaven National Lab., Upton, NY (USA). [1989]. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8904259–3: American Society for Precision Engineering spring conference, Tucson, AZ (USA), 25-27 Apr 1989). Order Number DE90016311. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Light scattering is an important if unwanted effect of imperfect surface finish. It can also be used for locating, identifying and quantifying surface and subsurface defects. Similar problems have been studied for many years in the field of microwave remote sensing and much of the extensive literature in that field has direct application to the present optical problem. This paper illustrates this approach by considering two elementary applications: topographic scattering from metal surfaces, and subsurface and bulk scattering from weakly inhomogeneous transparent materials. This approach has been developed into a practical method for the quality control of high-performance mirrors, while possible applications to subsurface damage are limited by the lack of availability of controlled experimental data.

46056 (CBPF-NF–080/88) **Moessbauer studies of ^{57}Fe substitution of Cu ions in superconducting oxides.** Saitovitch, E.B. Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil). 1988. 28p. Order Number DE90635764. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Since the discovery of high-T_c superconductivity in $YBa_2Cu_3O_7$ oxides several studies of metal ions substitutions were reported. The observed depression on T_c without a systematic correlation with the charge and magnetic moment of Cu substituents claims for more detailed information about its local properties as can be revealed by ^{57}Fe Moessbauer spectroscopy. The results for different iron concentrations combined with modifications of the superconducting transition are discussed concerning the presence of magnetic moments on the Fe ions and the preferential occupation of Cu(1) sites, recently confirmed by neutron and electron diffraction experiments. The oxygen coordination for the different iron species are proposed on the basis of their dependence on Fe concentration, their behavior at high temperatures as well as the electron diffraction and electron microscopy measurements reported for Fe: $YBa_2Cu_3O_7$ samples. (author).

46057 (IAERU–8904) **Proceedings of IAERU seminar-V.** Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Jan 1990. 89p. (In Japanese). (CONF-8906351–: 5. IAERU seminar, Tokyo (Japan), 24 Jun 1989). Order Number DE90513828. Source: NTIS (US Sales Only), PC A05/MF A01.

This issue is the collection of the papers presented at the title meeting on thermoluminescence and its application. The 5 of the presented papers are indexed individually. (J.P.N.).

46058 (IPNO-DRE–89-13) **A simple way to study secondary ion emission by heavy multicharged ions at medium energy (≃ 115 keV).** Brunelle, A.; Della-Negra, S.; Depauw, J.; Joret, H.; Le Beyec, Y. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 10p. Order Number DE90514629. Source: NTIS (US Sales Only), PC A02/MF A01.

A simple method to investigate the emission of H^+ and H^- ions from a surface is examined. Primary ions at an energy of about 120 keV in a large range of incident charge states between 1^+ and 18^+, are used. The emission of H^+ and H^- ions is studied as a function of the projectile charge state at a constant energy of 116

keV. For the H^+ yield, a strong charge state dependence is observed at this bombarding energy of 116 keV. The emission of secondary negative ions can also be observed. The variation of H^- ion yield shows no dependence on the bombarding charge state. It is considered that kinetic emission is the dominant process in this case. Two different mechanisms are involved in the desorption mechanisms of positive and negative hydrogen ions from a surface. The experiment confirms that the H^+ emission rate follows the power law $Y_{H^+} \simeq q_i^9$.

46059 (KURRI-TR-330) **Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities.** Nakagawa, M. (Kagawa Univ., Takamatsu (Japan)); Yoshida, H.; Okada, M. (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1990. 145p. (In Japanese). (CONF-8908245--: Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities, Kumatori (Japan); KUMATORI (is not a va Order Number DE90513870. Source: NTIS (US Sales Only), PC A07/MF A01.

This issue is the collection of the papers presented at the title meeting. The 19 of the presented papers are indexed individually. (J.P.N.).

46060 (LA-UR-90-1499) **A stochastic model for chemical vapor infiltration.** Currier, R.P. Los Alamos National Lab., NM (USA). [1990]. 8p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901073--4: 178. meeting of Electrochemical Society, Inc., Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90012147. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Chemical vapor infiltration (CVI) of fibrous substrates is considered to be Markovian stochastic process with film thickness a random variable. The approach implicitly accounts for difficult to describe aspects of the dynamics. Pore transition probabilities are introduced for passage between states of partial closure. Analytical results are obtained and compared for both a cylindrical and simple noncylindrical pore. 9 refs., 3 figs.

46061 (LA-UR-90-1500) **Chemical vapor infiltration in single fiber bundles.** Devlin, D.J.; Barbero, R.S.; Currier, R.P. Los Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901073--3: 178. meeting of Electrochemical Society, Inc., Seattle, WA (USA), 14-19 Oct 1990). Order Number DE90012101. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Chemical vapor infiltration (CVI) in single fiber bundles is studied under isothermal conditions. Understanding infiltration dynamics in single bundles is essential to process design and modeling efforts. Deposition of pyrolytic carbon in carbon-fiber bundles is chosen as the experimental system, with densification data obtained from thermogravimetric analysis. Data are then compared to predictions from a recently proposed CVI model for fiber bundle densification. 10 refs., 5 figs., 1 tab.

46062 (LBL-28788-Extd.Abst.) **Fresnel fringe effects at interfaces of thin multilayer structures.** Nguyen, T.D.; Gronsky, R.; Kortright, J.B. Lawrence Berkeley Lab., CA (USA). Mar 1990. 6p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Contract F49620-87-K-0001. (CONF-900877--5: 12. international congress for electron microscopy, Seattle, WA (USA), 12-18 Aug 1990). Order Number DE90015312. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent developments in the TEM Fresnel-fringe technique have provided an alternative method to the determination of structures and morphology of interfaces in multilayer thin film structures. This method has been employed in the investigation of structures and defects in grain boundaries, dislocations, precipitate platelets, twin boundaries, metal interfaces, and multilayer structures. It has been demonstrated that the fringe spacing primarily relates to the layer thickness, while the fringe contrast as a function of defocus relates to the magnitude of the localized change in the scattering potential and thus to the interfacial composition. The profile of the fringes is more closely related to the abruptness of the composition change at the interface. Other factors affecting the Fresnel fringe intensity are the specimen thickness, aperture size, beam convergence, and degree of tilt of the interface from the incident electron beam. This paper discusses this technique further. 13 refs., 3 figs.

46063 (LBL-29174) **Subpicosecond Raman study of hot electrons and hot phonons in GaAs.** Kim, D.S.; Yu, P.Y. Lawrence Berkeley Lab., CA (USA). Mar 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9003190--1: NATO advanced workshop on light scattering in semiconductors and microstructures, Quebec (Canada), 5-9 Mar 1990). Order Number DE90015634. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In this paper we will describe in detail the use of Raman scattering with subpicosecond laser pulses for investigating both the Frohlich interactions between electrons and LO phonons and the intervalley electron-phonon interactions. 19 refs., 6 figs.

46064 (LBL-29175) **Study of hot carrier relaxation in quantum wells by subpicosecond Raman scattering.** Kim, Dai-sik; Yu, P.Y. Lawrence Berkeley Lab., CA (USA). Mar 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9003189--1: 3. ultrafast laser probe phenomena in bulk and microstructure semiconductors, San Diego, CA (USA), 18-19 Mar 1990). Order Number DE90015635. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Relaxation of hot carriers excited by subpicosecond laser pulses has been studied by Raman scattering in GaAs/AlAs multiple quantum wells with well widths varying between 100 and 1000 Å. The hot phonon population observed by Raman scattering is found to decrease with the well width despite the fact that the hot electron temperature remains constant. The results are explained in terms of confinement of both electrons and optical phonons in quantum wells.

46065 (ORNL/FTR-3712) **[Complementary applications of diffraction by neutrons and x-ray synchrotron radiation]: Foreign trip report, July 16, 1990–August 3, 1990.** Smith, H.G. Oak Ridge National Lab., TN (USA). 20 Aug 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016132. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As Chairman of the Neutron Diffraction Commission, I reported on the past three year's activities of the commission to the Executive Committee of the International Union of Crystallography (IUCr) as well as on its future activities. I chaired a commission meeting with the old and new members in which future activities of the commission were discussed. I presented a poster on our research on the martensitic transformation of the alkali metals at the IUCr meeting in Bordeaux and had numerous scientific discussions with other attendees. At the conference on neutron and synchrotron radiation diffraction at Alpe d'Huez, I presented a postdeadline poster on our new neutron-sensitive TV-image-intensifier system and coauthored a poster presentation on our single-crystal studies of the martensitic transformation in sodium metal. I visited the Institut Laue-Langevin and observed their new instrumentation and discussed neutron-scattering experiments with members of their staff.

46066 (PINSTECH/NPD-124) **Molecular dynamics: application to liquid sodium.** Yaldram, K.; Sadiq, A.; Murad, S. Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Nuclear Physics Div. Apr 1989. 13p. Order Number DE90635768. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In the present study an alternate molecular dynamics techniques has been used to study the equilibrium and transport properties of liquid sodium, and in the process to acquire a working knowledge of this powerful simulation techniques. In this technique time evolution of position and velocities of atoms and molecules which constitute the system are investigated. This is done by constructing a suitable intermolecular potential model, and solving the equations of motion of these particles with a suitable numerical alogrithm. The information obtained can be used to study both its equilibrium as well as non-equilibrium properties. The present study, in addition to provide physical properties and data for design and experimental calculations in the prevalent working conditions, may also help in studying liquid sodium under conditions not accessible to the experimentalists. (orig./A.B.).

46067 (RAL-90-023) **Extending the power of powder diffraction for structure determination.** David, W.I.F. Rutherford Appleton Lab., Chilton (UK). Apr 1990. 12p. Order Number DE90635769. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Powder diffraction is a powerful material science technique. Using modern high resolution neutron and X-ray powder diffractometers, datasets may be obtained that contain an impressive amount of structural information and permit the refinement, using the Rietveld technique, of structures containing more than 100 positional parameters. Despite these technical advances and the renewed popularity of the technique, powder diffraction suffers from the inevitable loss of information imposed by the collapse of three dimensions of diffraction information on to the one dimension of a powder diffraction pattern. This can seriously frustrate the determination of unknown crystal structures. As a consequence of accidental or exact reflection overlap, only a relatively small number of reflections may have uniquely determined intensities. An obvious example of exact overlap are the cubic reflections 5 5 0, 7 1 0 and 5 4 3, all with the same d spacings. In this paper, a method is presented that is based upon a maximum entropy algorithm. It permits the determination from first principles of the intensities of overlapping reflections in powder diffraction profiles. Alternatively stated the method produces good ab initio reconstruction of three dimensional diffraction information from one dimensional powder data. Powder diffraction data effectively become quasi-single crystal data. It is anticipated that this method will considerably extend the power of the powder diffraction technique. (author).

46068 (UM-P-89/70) **Surface crystallography of haematite.** Bursill, L.A.; Peng JuLin; Fan XuDong. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 31p. Order Number DE90635770. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The surface crystallography of haematite (α-Fe_2O_3) has been investigated for a number of faces using atomic resolution surface profile imaging and computer-simulated image-matching. A remarkable variety of surface depolarizing mechanisms was observed, which included monolayer relaxation and reconstruction, as well as oriented overgrowth with monolayer compound formation and essentially electronic transitions without significant atomic displacements which mechanisms were found to apply with different emphasis for different facets. The structural results are discussed in terms of surface depolarization including double-layer and electronic mechanisms, coherency strains for monolayer compound formation of spinel-type structure onto haematite, electro-induced and chemical oxygen desorption mechanisms. Comparisons of haematite and sapphire surface crystallographies has been included in the discussion. (authors) 16 refs., figs., 1 tab.

46069 Spectrochemical analysis using laser plasma excitation. Radziemski, L.J. (New Mexico State Univ., Las Cruces, NM (USA). Dept. of Physics); Cremers, D.A. pp. 295-326 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper reports on analyses of gases, liquids, particles, and surfaces in which laser plasma is used to vaporize and excite a material. The authors present a discussion of the interaction between laser radiation and a solid and some recent analytical results using laser plasma excitation on metals. The use of laser plasmas as an ablation source is also discussed.

46070 Laser-based semiconductor fabrication. Wachter, J.R. (Los Alamos National Lab., NM (USA). Materials Science and Technology Div.). pp. 269-294 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper discusses research that has concentrated on methods for direct processing of integrated circuits (IC's), such as defect reduction in epitaxial silicon, large grain polysilicon growth, laser-assisted etching and film deposition methods, and removal of dislocation networks.

46071 Laser vaporization for sample introduction in atomic and mass spectroscopy. Sneddon, J. (Lowell Univ., MA (USA). Dept. of Chemistry); Mitchell, P.G.; Nogar, N.S. pp. 347-384 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper present a comparison of AAS and plasma-AES where the relative merits of sample throughput, detection limits, short-term precision, long-term reproducibility, dynamic range, interferences, element range, sample compatibility, qualitative analysis, ease of use, purchase price, and operating costs are discussed. The authors conclude that AAS and plasma-AES are capable of performing elemental analysis of solutions with good accuracy and precision and proposes that the technique used depends on the specific analytical requirement.

46072 Fundamentals of analysis of solids by laser-produced plasmas. Kim, Y.W. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Physics). pp. 327-346 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper presents the quantitative analysis of the elemental composition of a condensed-phase specimen by means of quantitative spectroscopic measurements of the emission spectra from a plasma plume produced off the surface of the specimen by focusing a high-power laser pulse. A discussion of the physics of the interaction of the laser pulse with the target specimen is offered. A narrowly focused phenomenology of the laser-heating mechanisms and the evolution of the plasma are presented. The formal basis of the quantitative spectroscopy is developed, connecting the measured line intensities to the thermodynamic state of the laser-produced plasma. Measurement of the intensities of the emission spectra of the laser-produced plasma and a determination of the elemental abundance of the specimen are treated and a summary is presented.

46073 Comment on "Quantum-mechanical interpretation of the exchange-correlation potential of Kohn-Sham density-functional theory". Rasolt, M. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (USA)); Geldart, D.J.W. *Physical Review Letters (USA),* 65(2): 276-276 (9 Jul 1990). DOE Contract AC05-84OR21400.

A Comment on the Letter by M. K. Harbola and V. Sahni, Phys. Rev. Lett. 62, 489 (1989).

46074 Efficient time integration of a viscoplastic model for shock waves. Rubin, M.B. (Earth Sciences Department, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550 (USA)). *Journal of Applied Physics (USA),* 68(3): 1356-1358 (1 Aug 1990). DOE Contract W-7405-ENG-48.

An unconditionally stable numerical procedure is developed to integrate the stiff differential equation associated with the flow rule for viscoplasticity used by Swegle and Grady [J. Appl. Phys. 58, 692 (1985)] to predict shock structure. Following the work of Rubin [J. Appl. Math. Phys. ZAMP 40, 846 (1989)] the flow rule is integrated implicitly and is converted into a scalar equation. It is shown that for the Swegle–Grady model this scalar equation reduces to a quadratic equation that can be solved without iteration.

46075 Validity, accuracy, and efficiency of multiple-scattering theory for space-filling scatterers. Butler, W.H. (Metals and Ceramics Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6114 (USA)); Nesbet, R.K. *Physical Review, B: Condensed Matter (USA),* 42(3): 1518-1525 (15 Jul 1990). DOE Contract AC05-84OR21400.

The equations of multiple-scattering theory (MST) are solved for the case of a lattice of square-well potentials in the shape of squares that fill the plane. We find that multiple-scattering theory is exact within reasonably achievable numerical accuracy. There *is* a problem with the convergence of MST in its traditional formulation that has obscured the fact that it is an exact theory even for non-muffin-tin, space-filling potentials. We show that this problem can be easily circumvented and describe a rapidly convergent, exact formulation of MST.

46076 Sputtering of excited-state potassium atoms from electron-bombarded KBr crystals. Kamada, M. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6123 (USA)); Arakawa, E.T. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films)*

(USA), 8(4): 3152-3156 (Jul 1990). DOE Contract AC05-84OR21400.

Sputtering of excited-state potassium atoms from electron-bombarded KBr crystals has been investigated at 300 and 443 K by measuring simultaneously the optical emission, Auger, and mass spectra. The beam current dependences of the intensities of the ground-state and excited-state potassium atoms at 443 K are nearly linear and quadratic, respectively, indicating that excited-state potassium atoms are produced by gas-phase collisions of potassium atoms desorbed from the surface. On the other hand, the room-temperature data show complicated dependences, which can be divided into three current regions. In the low-current region (<13 μA), electronic excitation followed by Auger-induced Coulomb repulsion produces the excited-state potassium atoms. In the high-current region (>25 μA), effects due to sample decomposition, nonstoichiometry, and gas-phase collisions play important roles in the production of excited-state potassium atoms. The nonlinear sputtering yield of excited-state potassium atoms in the intermediate-current region may be due to secondary effects including the formation of defects and cluster ions.

46077 Slow positron annihilation spectroscopy and electron microscopy of electron beam evaporated cobalt and nickel silicides. Frost, R.L. (Georgia Institute of Technology, Atlanta, Georgia 30332 (USA)); DeWald, A.B.; Zaluzec, M.; Rigsbee, J.M.; Nielsen, B.; Lynn, K.G. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3210-3217 (Jul 1990). DOE Contract AC02-76CH00016.

Metal silicide thin films on single-crystal silicon substrates are the subject of much research, due to their applications as electrical contacts and interconnects, diffusion barriers, low resistance gates, and field-assisted positron moderators, among others. Defects within the silicide layer and/or at the silicide/silicon interface are detrimental to device performance, since they can act as traps for charge carriers, as well as positrons. Pinholes penetrating the film are another detriment particularly for cobalt silicide films, since they allow electrons to permeate the film, rather than travel ballistically, in addition to greatly increasing surface area for recombination events. A series of epitaxial cobalt and nickel silicide thin films, deposited via electron-beam evaporation and annealed at various temperatures, have been grown on single-crystal silicon (111) substrates, in an effort to establish a relationship between deposition and processing parameters and film quality. The films have been analyzed by transmission and scanning electron microscopy, sputter depth profile Auger, and slow positron annihilation spectroscopy. The latter has been shown to both correlate and complement the traditional electron microscopy results.

46078 Dynamical scaling during interfacial growth in the one-sided model. Jasnow, D. (Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15260 (USA)); Vinals, J. *Physical Review, A (General Physics) (USA)*, 41(12): 6910-6921 (15 Jun 1990). DOE Contract FC05-85ER25000.

We study the temporal evolution of a planar interface that separates two coexisting phases, after it becomes morphologically unstable. We solve numerically the interface equation of motion of the one-sided model in two dimensions. Evidence is presented for the appearance of a regime of self-similar growth in which the evolving pattern is characterized by a single, time-dependent length scale, $R(t)$, in agreement with earlier similar studies in the two-sided symmetric model. We have implemented a renormalization procedure to obtain the asymptotic time dependence of $R(t)$. We find $R(t) \sim t$ at sufficiently long times. We also show that the asymptotic scaling behavior is determined by the driving term in the equations of motion. This term is proportional to the flux externally imposed ahead of the moving interface. The stabilizing contribution, which is proportional to the capillary length, is shown to be irrelevant for the large-scale behavior. We finally study the effects introduced by anisotropic surface tension and show that the asymptotic behavior of the system remains unchanged.

6561 Superconductivity

Refer also to citation(s) 44685, 44694, 44695, 44696, 44697, 44702, 44704, 44727, 44764, 44766, 44767, 44779, 44782, 45024, 45119, 45204, 46056

46079 (AD-A-221077/1/XAB) **Surface-wave characterization of high-Tc superconductors. Final report, 30 September 1984-30 September 1989.** Wisconsin Univ., Milwaukee, WI (USA). Dept. of Physics. 26 Mar 1990. 20p. Source: NTIS, PC A03/MF A01.

High Tc superconducting controlling elements for frequency tunable surface acoustic wave SAW filters and dispersion lines in the 0.5 to 4 GHz range have been proposed and designed. Ultrasonic attenuation and velocity measurements in sinter forged YBa2Cu3O7 indicate that the sound waves are interacting with excitations which are confined to the CuO planes. Proximity SAW coupling to a two-dimensional electron gas 2 DEG has placed limits on the localization lengths of the 2 DEG. A new phase transition has been ultrasonically discovered in the mixed state of the heavy Fermion superconductor UPt3. An anomalous increase in attenuation in the superconducting state of the reentrant superconductor system Er(1-x)Ho(x)Rh(4)B4 implies a novel interaction mechanism in this system. SAW measurements on granular superconducting films demonstrate that SAW measure the sheet resistivity of these films on a length scale comparable to the SAW wavelength.

46080 (DOE/ER/45297-13) **dV/dI double peak structures in superlattice-based tunnel junctions.** Maritato, L. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Cucolo, A.M.; Vaglio, R.; Noce, C.; Makous, J.L.; Falco, C.M. Arizona Univ., Tucson, AZ (USA). [1988]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45297. (CONF-881127-6: Conference on the science and technology of thin film superconductors, Colorado Springs, CO (USA), 14-18 Nov 1988). Order Number DE90015515. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We realized high quality tunnel junctions using bcc-bcc Mo-Ta superlattices in the modulation wavelength range 16-450 Å as the first electrode. The dV/dI vs. V characteristics showed a double peak structure in the wavelength range 50-250 Å. We fitted the temperature behavior of these structures using both a two band model and the proximity effect theory. Preliminary calculations of a possible microscopic explanation of this data are presented. 8 refs., 4 figs.

46081 (IC-90/50) **Cation substitution studies in $YBa_2Cu_3O_{7-d}$ structure.** Matacotta, F.C.; Segre, C.U.; Infante, C.; Ramos Arhuis, J.; Ma, B.; Ganguly, P. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 8p. Order Number DE90636257. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

The suppression of superconductivity by the substitution of divalent cations such as Sr or Ca at Y and Ba sites in $Y\ Ba_2Cu_3O_{7-d}$ and the substitution of Pr for La in $LaCaBaCu_3O_{7-d}$ has been examined by ac susceptibility and infra-red spectroscopy. The latter has been found to be particularly useful in obtaining information at the microscopic level regarding the influence of substitution at the planes and at the chains. The studies give support for the model of enhancement of superconductivity by charge fluctuations in the chains. the systematics of the changes in the electrical resistivity in $La_{1-x}Pr_xCaBaCu_3O_{7-d}$ is examined in terms of the percolation models and the existence of a minimum sheet resistance for superconductivity. The role of the various substituents in stabilizing the structure and also in the mechanism for superconductivity is examined in terms of a model for the structure of the superconducting $A_mCu_nO_y$ copper oxides on the basis of AX_3 close-packing and the uniaxial magnetic interaction model. (author). 12 refs, 6 figs.

46082 (IC-90/58) **Nonlocal Ginzburg-Landau equations. I. Pure case.** Xu Honghua (International Centre for Theoretical Physics, Trieste (Italy)); Wu Xiaoxing; Tsai Chienhua. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 20p. Order Number DE90636258. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Starting from the BCS Hamiltonian, we succeeded to establish, in the pure case, nonlocal Ginzburg-Landau equations which reduce to their conventional form in the local limit and lead naturally to a reversal of the magnetic field in the neighbourhood of a vortex in type II/1 superconductors. The form factor resulted from first principle calculation is in nice agreement with neutron scattering data. (author). 15 refs, 3 figs.

46083 (LBL–29215) **High resolution transmission electron microscopy of partial states of oxygen order in $YBa_2Cu_3O_z$.** Burmester, C.P. (California Univ., Berkeley, CA (USA). Dept. of Materials Science and Mineral Engineering); Quong, S.; Gronsky, R.; Wille, L.T.; Ahn, B.T.; Lee, V.Y.; Beyers, R.; Guer, T.M.; Huggins, R.A. Lawrence Berkeley Lab., CA (USA). May 1990. 6p. Sponsored by U.S. Department of Defense. DOE Contract AC03-76SF00098. Grant MDA 9720-88-J-1006. (CONF-900466–77: Spring meeting of the Materials Research Society, San Francisco, CA (USA), 16-21 Apr 1990). Order Number DE90015637. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High resolution electron microscopy is used to investigate the effect of electron irradiation induced oxygen loss on the states of partial order in $YBa_2Cu_3O_z$. Contrast effects visible in the [001] zone image as a result of the degree of the out-of-plane correlation of these ordered states are investigated. Using statistical simulations to aid in the analysis of the HREM images, an interpretation based on a kinetically limited evolution of the variation of long range [001] ordering is proposed.

46084 (ORNL/FTR–3698) **[Superconductivity and information exchange]: Foreign trip report, June 24, 1990–July 24, 1990.** Klemm, R.A. Oak Ridge National Lab., TN (USA). 8 Aug 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015767. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The author was invited to visit several institutions in Europe for the purposes of collaboration, information exchange, and presentation of seminars. Extensive exchanges of information regarding the current state of field in high-temperature superconductivity took place. Five seminars on the recent work of Klemm and Liu on interlayer pairing were given, and the response was very favorable. A new collaboration on the role of gap anisotropy on the physical properties of high-temperature superconductors was begun. 6 refs., 1 tab.

46085 (PB–90-873290/XAB) **Thin superconducting films: Sputtering, characterizations, and applications. January 1975-December 1987 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-December 1987.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 141p. Source: NTISPC N01/MF N01.

See also PB–90-873308.

This bibliography contains citations concerning the theories, production, characterizations, and applications of thin superconducting films. Sputtering techniques for fabricating thin superconducting films from transition metals, rare earth compounds, aluminum group metals, and germanium group metals are discussed. Their electrical, magnetic, and thermal properties are also examined. Topics include critical characteristics, transition temperatures, superconductive tunnelling and junctions, electrical impedances and energy gaps, persistent currents, and size effects. Thin superconducting film applications include optical detection, optical switching, Josephson junctions, microwave devices, and surface acoustic devices. (This updated bibliography contains 302 citations, none of which are new entries to the previous edition.)

46086 (PB–90-873308/XAB) **Thin superconducting films: Sputtering, characterizations, and applications. January 1988-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1988-June 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 233p. Source: NTISPC N01/MF N01.

Supersedes PB–88-855507. See also PB–90-873290.

This bibliography contains citations concerning the theories, production, characterizations, and applications of thin superconducting films. The sputtering and evaporation techniques for depositing high temperature superconducting thin films of Y-Ba-Cu-O, Bi-Sr-Ca-Cu-O, and Tl-Ca-Ba-Cu-O on various substrates such as semiconductors, metallic materials, silicon, alumina, strontium titanate, zirconia, and sapphire are discussed. Electrical, magnetic, thermal, and transport properties of thin films are examined. Thin superconducting film applications include superconducting quantum interference devices (SQUIDS), tunnel junctions, transmission lines, and magnetic materials. (This updated bibliography contains 410 citations, all of which are new entries to the previous edition.)

46087 (UM-P–89/106) **Studies of the electronic structure by XPS of HTSC and related compounds.** Myhra, S. (Griffith Univ., Brisbane (Australia)); Bocquet, A.E.; Dobson, J.F.; Healy, P.C.; Goodman, P.; Stewart, A.M.; Thompson, J.G.; White, T.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 4p. Order Number DE90636261. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Measurements by photoemission spectroscopy have shown that the chemical environments of alkaline earth cations in high temperature superconductor compounds are different from the normal environments of these ions in the prototype perovskite structures. A recently discovered HTSC compound ($Pb_2Sr_2Y_O$. $5Ca_O$. $5Cu_3O_8$) exhibits the exceptional feature of having a typical HTSC signature for Sr, while Ca shows a normal signature. The crystal-chemical features of the relevant compounds have been correlated with these observations. These correlations may be indicative of inter-layer electronic interactions. 16 refs., 3 figs., 1 tab.

46088 **Superconductivity: After the fad.** Schriesheim, A. (Argonne National Lab., IL (USA)). *Proceedings of the American Power Conference (USA)*, 51: 22-26 (1989). (CONF-890425–: American power conference, Chicago, IL (USA), 24-26 Apr 1989).

The author discusses the impact that new high-temperature superconductors are likely to have on the electric utility industry. The author identifies some of the practical problems that will have to be overcome first. This paper also gives an overview of the various efforts under way to solve those problems.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 44974, 45737, 45870, 45876, 45886, 45887, 46166, 46270, 46323, 46324

46089 (BiBoS–367/89) **Jump processes and diffusions in relativistic stochastic mechanics.** De Angelis, G.F. (Rome-1 Univ. (Italy). Dipt. di Matematica); Serva, M. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS). 1989. 11p. Source: Available from Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

There are two stochastic descriptions of relativistic quantum spinless particles. In the first one, inspired by Feynman's path integral approach to Klein-Gordon propagator, the main ingredients are diffusions in Minkowski space parametrized by some kind of proper time. The second description, on the contrary, is based upon jump Markov processes giving the space position of the particle in the sense of Newton and Wigner with the time as parameter. In this paper we bridge the gap between these probabilistic scenarios by constructing the space jump processes by means of space-time diffusions. Some applications to the nonrelativistic limit of hamiltonian semigroups are given. (orig.).

46090 (BiBoS–384/89) **On a realistic theory for quantum physics.** Duerr, D. (Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)); Zanghi, N.; Goldstein, S. Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS). 1989. 18p. Source: Available from Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS).

We discuss some ideas about quantum physics which we think are of relevance for the future evolution of the field. These ideas, though old, are either unknown or misunderstood. Our point here is that a strong realistic position has consequences: It offers a completely natural understanding of 'standard quantum mechanics'; it fully reveals the nonlocal character of nature and it guides the

search for a fundamental unified theory of the microscopic and macroscopic world. (orig.).

46091 (DOE/ER/25019–18) **Adiabatic invariance and transient resonance in very slowly varying oscillatory Hamiltonian systems.** Bosley, D.L.; Kevorkian, J. Washington Univ., Seattle, WA (USA). Jul 1990. 55p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER25019. Order Number DE90016118. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Canonical averaging techniques are applied to very slowly varying oscillatory systems in Hamiltonian standard form to very high orders, which are required for uniformly valid solutions. When resonance is exhibited in these systems N-1 adiabatic invariants are found, reducing the original system of 2N first-order differential equations which embody the resonance behavior. Three examples exhibiting transient resonance are examined. Transient resonance occurs when the leading order frequency of the reduced system makes a slow passage through zero. Depending on the rate of this slow passage, three distinguished cases are identified: the subcritical, the critical, and the supercritical. For each case, asymptotic solutions are found illustrating the nature of the resonance for certain classes of problems. In both the critical and supercritical cases, the action (and correspondingly the energy) can undergo changes of O(1) or greater. Specific examples are used to illustrate and numerically verify all results.

46092 (ETDE-IT–90-30) **Evolution of quantum states driven by a time-dependent harmonic oscillator.** Dattoli, G.; Torre, A.; Mignani, R. ENEA, Frascati (Italy). Centro Ricerche Energia; Rome Univ. (Italy). Ist. di Fisica. 1989. 24p. Order Number DE90514506. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Physical Review A.

Recently, damped harmonic of the Caldirola-Kanai (CK) type have been actively considered for their practical importance to solve problems in optics such as those associated with the field decay in a Fabry-Perot cavity. In this paper, the quantum mechanical properties of the time-dependant harmonic oscillator are studied using different methods, e.g., the coordinate or creation-annihilation operator representation or utilizing the coherent state formalism. A mathematical formalism, based on the spinor image method, is shown to be the unifying thread of the different tools of analysis. As a specific example, the property of the Caldirola-Kanai harmonic oscillator is discussed.

46093 (EUR-CEA-FC–1373) **Cascade mode locking: a possible route to chaos in the two-waves hamiltonian system.** Gell, Y.; Nakach, R. Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee. Jun 1989. 18p. Source: NTIS (US Sales Only), PC A03/MF A01.

We present a numerical study of the two-waves Hamiltonian system which reveals the route to large scale stochasticity as a process based on the mode-locking phenomenon. The final chaos is reached after a cascade of lockings, appearing successively for different independent modes of oscillation in the system. Using a Fourier analysis, the different steps in this cascade process are detected by following the change in the frequency of the pronounced modes in the power spectrum; when changing the strength of the pertubation, one observes the locking of the relevant mode to a fixed frequency inherent to the system. It is shown that this mechanism allows for the generation of low frequency oscillations which, due to the nonlinear coupling existing in the system, combine with all the existing peaks into a raised spectrum consisting of broad diffuse patterns, which is the signature of chaotic motion.

46094 (IC–89/378) **Superconformal geometry from the Grassmann and harmonic analyticities II: The N=4SU(2) conformal case.** Saidi, E.H.; Zakkari, M. International Centre for Theoretical Physics, Trieste (Italy). May 1990. 36p. Order Number DE90635649. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

N=4SU(2) conformal invariance is studied in harmonic superspace. It is shown that the N=4SU(2) conformal structure is equivalent to the harmonic analyticity. The solutions of the superconformal constraints are worked out in detail and the conformal properties of all objects of interests are given. A realization of the N=4 current in terms of the free (F.S.) hypermultiplet is obtained. (author). 10 refs.

46095 (IC–90/24) **Examples of harmonic map heat flow in dimension two.** Ma Li. International Centre for Theoretical Physics, Trieste (Italy). Jan 1990. 3p. Order Number DE90635650. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

An example of explosion of the heat flow at infinite time in dimension two and an arbitrary degree is given. (author). 4 refs.

46096 (IC–90/28) **Some remarks on the minimizers of variational integrals with non-standard growth conditions.** Hong Minchun. International Centre for Theoretical Physics, Trieste (Italy). Feb 1990. 11p. Order Number DE90635651. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this paper, we give a new counterexample to the regularity problem of variational integrals in the scalar case, and prove the L^{∞}-regularities of Q-minimas of the variational integrals with non standard growth conditions. (author). 10 refs.

46097 (IC–90/30) **Harmonic map heat flow with free boundary.** Ma Li. International Centre for Theoretical Physics, Trieste (Italy). Feb 1990. 21p. Order Number DE90635652. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In this paper, we study the harmonic map heat flow with free boundary from a Riemannian surface with smooth boundary into a compact Riemannian manifold. As a consequence, we get at least one disk-type minimal surface in a compact Riemannian manifold without minimal 2-sphere. (author). 9 refs.

46098 (IC–90/47) **On the first initial boundary value problem for parabolic equations.** Lopez Morales, M. International Centre for Theoretical Physics, Trieste (Italy). Mar 1990. 15p. Order Number DE90635653. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

In the present paper we establish the solvability (existence and uniqueness of the solution) of the first initial-boundary value problem for linear and nonlinear parabolic equations of second order in a cylindrical domain, under the assumption of Hoelder continuity of the coefficients only with respect to the space variables. The corresponding solutions and its derivatives up to the second order inclusively satisfy the Hoelder condition with respect to the space variable and with respect to the time. (author). 13 refs.

46099 (IC–90/62) **Equivalence of two dimensional gravities.** Mohammedi, N. International Centre for Theoretical Physics, Trieste (Italy). Mar 1990. 11p. Order Number DE90635673. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We find the relationship between the Jackiw-Teitelboim model of two-dimensional gravity and the SL(2,R) induced gravity. These are shown to be related to a two-dimensional gauge theory obtained by dimensionally reducing the Chern-Simons action of the 2+1 dimensional gravity. We present an explicit solution to the equations of motion of the auxiliary field of the Jackiw-Teitelboim model in the light-cone gauge. A renormalization of the cosmological constant is also given. (author). 13 refs.

46100 (IC–90/72) **On totally geodesic foliations of negatively curved manifolds of finite volume.** Verjovsky, A.; Walczak, P.G. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 5p. Order Number DE90635654. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

We prove that if M is a complete Riemannian manifold of bounded negative curvature and finite volume, then for any totally geodesic C^3-foliation F of M we have dim F $\leq$ codim F. 7 refs.

46101 (IC–90/80) **A geometric characterization of focal manifolds of isoparametric submanifolds.** Olmos, C. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 14p. Order Number DE90635655. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We show that the (local) foliation in the ambient space, whose leaves are the holonomy submanifolds through small principal vectors of the normal space, is a parallel foliation having the given submanifolds as a focal parallel manifold (in particular each leaf has flat normal bundle). 8 refs.

46102 (IC–90/82) **Minimal relative relation modules of finite p-groups.** Yamin, M. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 4p. Order Number DE90635656. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Consider $1 \rightarrow S \rightarrow E \rightarrow G \rightarrow 1$, where G is a finite p-group generated by g_i, $1 \leq i \leq d$, and E a free product of cyclic groups $< g_i >$, $1 \leq i \leq d$. If d is the minimum number of generators for G then we prove that the largest elementary abelian p-quotient $S/S'S^p$, regarded as an F_pG-module via conjugation in E, in nonprojective and indecomposable. (author). 5 refs.

46103 (IC–90/86) **On interior estimates of the integral moduli of continuity for derivatives of solutions of elliptic equations.** Lopez Morales, M. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 17p. Order Number DE90635657. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We consider a general linear elliptic equation of higher order in a bounded domain. Under the assumptions that the independent term belongs to Lp, $p > 1$, satisfies the Hoelder condition in Lp, $p > 1$, with exponent α, $0 < \alpha < 1$, and the coefficients satisfy the usual Hoelder condition with exponent α, we establish a priori interior estimates for the integral moduli of continuity of the derivatives of generalized solutions of the equation. The constant in these estimates does not depend on p. (author). 14 refs.

46104 (IC–90/87) **Relativistic dynamical reduction models: General framework and examples.** Ghirardi, G.C. (International Centre for Theoretical Physics, Trieste (Italy)); Grassi, R.; Pearle, P. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 63p. Order Number DE90635663. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

The formulation of a relativistic theory of statevector reduction is proposed and analyzed, and its conceptual consequences are elucidated. In particular, a detailed discussion of stochastic invariance and of local and nonlocal aspects at the level of individual systems is presented. (author). 35 refs, 5 figs.

46105 (IC–90/89) **An integrality theorem for spin^c manifolds.** Seade, J.A. International Centre for Theoretical Physics, Trieste (Italy). Apr 1990. 6p. Order Number DE90635658. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

A spin^c manifold M^n is an oriented, Riemannian manifold with an associated hermitian line bundle det(M), together with a lifting to $B(spin_n^c)$ of the classifying map of the bundle TMxU(1). We prove here an integrality theorem for spin^c manifolds. 11 refs.

46106 (KEK–89-22, pp. 253-260) **Wormhole solutions in the Skyrme model.** Iwazaki, A. (Nishogakusha Univ., Shonan, Chiba (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1990. (CONF-8911199–: Workshop on topology, field theory and superstrings, Tsukuba (Japan), 6-10 Nov 1989). In *Proceedings of the workshop 'topology, field theory and superstrings'.* Order Number DE90798858. Source: NTIS (US Sales Only), PC A17/MF A01.

We present wormhole solutions in the Skyrme model coupled with gravity. The wormholes have topological numbers which are identical with those of Skyrmions: they are baryon numbers. We discuss physical implications of the wormholes. (author).

46107 (LA-UR–90-2272) **Polarization modulated solitary waves in an optical fiber.** David, D.; Tratnik, M.V. Los Alamos National Lab., NM (USA). [1990]. 15p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-9005237–3: 10. annual conference on nonlinear science: the next decade, Los Alamos, NM (USA), 21-25 May 1990). Order Number DE90015034. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A family of solitary waves is found which satisfy the coupled nonlinear Schroedinger equations governing optical pulse propagation in an elliptical core optical fiber. These are polarization modulated pulses which are bound states of two solitons which when decoupled have constant and uniform orthogonal linear polarizations. The information of these bound states is possible only above a minimum energy threshold determined by the ellipticity of the fiber. 6 refs., 4 figs.

46108 (LBL–28702) **Modes of elliptical waveguides; A correction.** Goldberg, D.A.; Laslett, L.J.; Rimmer, R.A. Lawrence Berkeley Lab., CA (USA). Mar 1990. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90016647. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We show that the fields associated with the TM_{01} mode of an elliptical wave guide are qualitatively different from those which have appeared in the standard literature for the past fifty years, and that the original fields as plotted were also in qualitative disagreement with the analytic expressions which accompanied them. Nonetheless, the cutoff frequencies given for that mode, as well as for the five other modes described in those references, are exceedingly accurate (within roughly 1%) for elliptical eccentricities as large as 0.75; for eccentricities in excess of 0.9, the inaccuracy increases to from 5 to nearly 50%, depending on the mode in question.

46109 (NBI-HE–90-22) **Properties of loop equations for the Hermitean matrix model and for two-dimensional quantum gravity.** Ambjoern, J. (Niels Bohr Inst., Copenhagen (Denmark)); Makeenko, Yu.M. Niels Bohr Inst., Copenhagen (Denmark). May 1990. 19p. Order Number DE90635675. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

We study properties of the loop equations for the NxN Hermitean matrix model with arbitrary (even) interaction as well as of their continuum limit, associated with the two-dimensional quantum gravity. We apply the general procedure of iterative solution proposed recently by David. We relate the specific heat to the singular behavior of the connected correlator of two loops. We solve the continuum equation to a few lower orders in the string coupling constant, obtaining results for macroscopic loops, including the case of a multicritical fixed point. (orig.).

46110 (RCNP-P–108, pp. 33-37) **Quantum chaos and nuclear spectroscopy.** Tsukuma, Hidehiko (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Nov 1989. (In Japanese). (CONF-8908235–: Workshop on nuclear structure by gamma spectroscopy, Ibaraki (Japan), 31 Aug - 2 sep 1989). In *Proceedings of the workshop on nuclear structure by gamma spectroscopy.* Order Number DE90798857. Source: NTIS (US Sales Only), PC A09/MF A01.

Based on the quantum theory of the self-consistent collective coordinate method, we propose a general method of evaluating the stochasticity in the quantum many-body system. Within the model calculation using simple soluble 3-level model, we also investigate the way to get a signal on the phase change from order to chaos by the statistical compilation of the information of the transition probability. (author).

46111 (RRK–90-3) **On a simple evaluation of anomalies from the path integral measure.** Inagaki, Takeshi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Feb 1990. 14p. Order Number DE90513707. Source: NTIS (US Sales Only), PC A03/MF A01.

Anomalies can be evaluated as the non-trivial Jacobian factors of the path integral measure. We make several comments on this calculation by taking two-dimensional gravity theories as examples. We present a new calculational method which makes practical calculations much simpler. (author).

46112 (RRK–90-4) **Topological aspects of classical and quantum (2+1)-dimensional gravity.** Soda, Jiro. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. Mar 1990. 58p. Order Number DE90513792. Source: NTIS (US Sales Only), PC A04/MF A01.

To understand (3+1)-dimensional gravity, (2+1)-dimensional gravity is studied as a toy model. Our emphasis is on its topological aspects, because (2+1)-dimensional gravity without matter fields has no local dynamical degrees of freedom. Starting from a review of the canonical ADM formalism and York's formalism for the initial value problem, we will solve the evolution equations of (2+1)-dimensional gravity with a cosmological constant in the case of g=0 and g=1, where g is the genus of Riemann surface. The dynamics of it is understood as the geodesic motion in the moduli

space. This remarkable fact is the same with the case of (2+1)-dimensional pure gravity and seen more apparently from the action level. Indeed we will show the phase space reduction of (2+1)-dimensional gravity in the case of g=1. For $g \geq 2$, unfortunately we are not able to explicitly perform the phase space reduction of (2+1)-dimensional gravity due to the complexity of the Hamiltonian constraint equation. Based on this result, we will try to incorporate matter fields into (2+1)-dimensional pure gravity. The linearization and mini-superspace methods are used for this purpose. By using the linearization method, we conclude that the transverse-traceless part of the energy-momentum tensor affects the geodesic motion. In the case of the Einstein-Maxwell theory, we observe that the Wilson lines interact with the geometry to bend the geodesic motion. We analyze the mini-superspace model of (2+1)-dimensional gravity with matter fields in the case of g=0 and g=1. For g=0, a wormhole solution is found but for g=1 we can not find an analogous solution. Quantum gravity is also considered, and we perform the phase space reduction of (2+1)-dimensional gravity in the case of g=1 at the quantum level. From this analysis we argue that the conformal rotation is not necessary in the sense that the Euclidean quantum gravity is inappropriate for the full gravity.

46113 (UCRL-CR-104583) **Path integral asymptotics in the absence of classical paths.** Schulman, L.S. (Clarkson Univ., Potsdam, NY (USA). Dept. of Physics); Ziolkowski, R.W. Lawrence Livermore National Lab., CA (USA). Jul 1990. 26p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90016213. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When a boundary value problem in classical mechanics has no solution, the corresponding quantum propagator may be asymptotically dominated by locally flawed classical paths. We indicate how this assertion can be made precise and show how one calculates the propagator under these circumstances. The essential tools in our arguments will be the use of neutralizers and the path decomposition formula for path integrals. With this method the propagator for barrier penetration is expressed as an integral over real tunneling time, defined as the interval between first striking the barrier and last emerging from it. 14 refs., 3 figs.

46114 (UM-P-89/47) **Non-relativistic quaternionic quantum mechanics in one dimension.** Davies, A.J.; McKellar, B.H.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 23p. (OZ-P-89/13). Order Number DE90635665. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

A formalism is presented for treating one dimensional problems in quaternionic quantum mechanics. As an example, an explicit form for the T matrix for scattering from a square (quaternionic) barrier is derived and this result used to calculate the transmission and reflection coefficients. The qualitative form of these coefficients is shown to be the same as in complex quantum mechanics, even when the barrier has a non-zero value for the quaternionic components of the potential. 7 refs., 2 figs.

46115 (UM-P-89/63) **Virial coefficients in the presence of an infinite number of bound states and strongly repulsive potentials: application to the Efimov point.** Pisani, C.; McKellar, B.H.J. Melbourne Univ., Parkville (Australia). School of Physics. [1989]. 44p. Order Number DE90635666. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Extending some work of Bolle'(1987), the authors construct expressions' for the n-particle cluster coefficients which remedy difficulties associated with the presence of both an infinite number of bound states and strongly repulsive potentials. The validity of these expressions is demonstrated by appealing to the existent theorems for cluster coefficients. A formalism is applied to obtain an expression for b_3 at the Efimov point. It was also possible to directly observe the divergence in b_3 due to the continuum part of the 3-body resolvent together with the counterterms which render it convergent. 18 refs., 3 figs.

46116 (UM-P-89/79) **Coriolis and magnetic forces: the gyrocompass and magnetic compass as analogues.** Opat, G.I. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 15p. Order Number DE90635667. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Coriolis force on a particle (acting within a rotating frame) and the magnetic force on a charge, are both proportional to and act perpendicular to the velocity. It is then argued that, the action of the Coriolis force on rotating mass, and the action of the magnetic force on rotating charge are formally identical. Just as the action of a magnetic field is to align the axis of the rotating charge distribution (magnetic dipole) with itself, so the Coriolis force aligns the axis of a rotating mass distribution (angular momentum) with the angular velocity of the rotating frame. This enables to understand the gyrocompass by analogy with the magnetic compass. A simple way to demonstrate the gyrocompass to a class is also presented. 4 refs., 3 figs.

46117 (UM-P-89/80) **Fourier analysis on trees as related to p-adic string theory.** O'Loughlin, M.; Joshi, G. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 25p. (OZ-89/25). Order Number DE90635668. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

After reviewing p-adic numbers, their relationship to trees, and some recent proposals for actions of a p-adic string theory with a tree-like world sheet, the possibility of constructing p-adic vertex operators in a similar way to the Frenkel-Kac construction of Kac-Moody algebras, is investigated. 25 refs., 5 figs.

46118 (UM-P-89/93) **A relationship between Gel'fand-Levitan and Marchenko kernels.** Kirst, T. (Hamburg Univ. (Germany, F.R.). Theoretische Kernphysik); Von Geramb, H.V.; Amos, K.A. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 6p. Order Number DE90635659. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

Submitted for publication to Inverse Probl. Sep 1989.

An integral equation which relates the output kernels of the Gel'fand-Levitan and Marchenko inverse scattering equations is specified. Structural details of this integral equation are studied when the S-matrix is a rational function, and the output kernels are separable in terms of Bessel, Hankel and Jost solutions. 4 refs.

46119 (UM-P-89/102) **Restrictions on potentials in the quaternionic Dirac equation.** Davis, A.J. Melbourne Univ., Parkville (Australia). School of Physics. 1989. 9p. (OZ-89/34). Order Number DE90635664. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

It is demonstrated that potentials with quaternionic parts are not allowed in the Dirac equation for quaternionic fields in the case of unitary source-free scattering. When recent non-relativistic results are considered, this result casts doubt on the existence of simple experimental tests of Quaternionic Quantum Mechanics. 9 refs.

46120 (UWThPh-1990-25) **Gauge field governing parallel transport along mixed states.** Uhlmann, A. Vienna Univ. (Austria). Inst. fuer Theoretische Physik. 29 Jun 1990. 9p. Order Number DE90635669. Source: NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS.

At first a short account is given of some basic notations and results on parallel transport along mixed states. A new connection form (gauge field) is introduced to give a geometric meaning to the concept of parallelity in the theory of density operators. (Author) 11 refs.

46121 A synthetically accelerated weighted diamond scheme for charged-particle transport calculations. Honrubia, J.J. (Universidad Politecnica de Madrid (Spain)); Morel, J.E. *Nuclear Science and Engineering (USA),* 104(2): 91-111 (Feb 1990).

A new weighted diamond scheme is developed to solve the linear Fokker–Planck equation for suprathermal charged-particle transport. Such a scheme is based on the preservation of the asymptotic behavior of the linear discontinuous finite element scheme previously proposed. A simpler steplike scheme has been also considered. The results show that the weighted diamond scheme is as accurate as the linear discontinuous one, preserving the energy-position-angle correlation of charged-particle slowing down with less calculational effort. The steplike scheme does not preserve this coupling, giving results similar to those obtained by multigroup methods. A spectral analysis of the iteration of the scattering term shows that the convergence process can be unacceptably slow

when the momentum transfer cross section is dominant. Consequently, the weighted diamond scheme has been accelerated by the S_2 synthetic method, significantly improving its convergence rate. The results show that the accelerated weighted diamond scheme is highly effective for electron transport calculations.

46122 Variational constraints for electrical-impedance tomography. Berryman, J.G. (Lawrence Livermore National Laboratory, P.O. Box 808, L-156, Livermore, CA (USA)); Kohn, R.V. *Physical Review Letters (USA),* 65(3): 325-328 (16 Jul 1990). DOE Contract W-7405-ENG-48.

The task of electrical-impedance tomography is to invert boundary measurements for the conductivity distribution of a body. This inverse problem can be formulated so the primary data are the measured powers dissipated across injection electrodes. Then, since these powers are minima of the pertinent (dual) variational principles, feasibility constraints can be found for the nonlinear inversion problem. When power may be measured accurately, the existence of these dual variational principles implies that any exact solution must lie at a point of intersection of the two feasibility boundaries.

46123 Biased random walk on a deterministic fractal. Parrondo, J.M.R. (Department of Chemistry, B-040—Institute for Nonlinear Science, R-002, University of California, San Diego, La Jolla, California 92093 (USA)); Martinez, H.L.; Kawai, R.; Lindenberg, K. *Physical Review, A (General Physics) (USA),* 42(2): 723-730 (15 Jul 1990). DOE Contract FG03-86ER13606.

Anisotropic diffusion on a Sierp*riaa*nski gasket is studied using renormalization equations for the probability densities of waiting times. The effect of an external field on a random walk is described in terms of the dependence of hopping probabilities, mean waiting times, and standard deviations on the hopping distance and on the intensity of the field. Our procedure can also be applied to other deterministic fractals.

46124 Classical theory of radiating strings. Copeland, E. (School of Mathematical and Physical Sciences, University of Sussex, Brighton BN1 9QH (United Kingdom)); Haws, D.; Hindmarsh, M. *Physical Review, D (Particles Fields) (USA),* 42(2): 726-730 (15 Jul 1990).

We calculate to first order in classical perturbaton theory the divergent part of the self-force of a radiating string coupled to gravity, an antisymmetric tensor, and a dilaton in four dimensions. While this divergence can be absorbed into a renormalization of the string tension, demanding that both it and the divergence in the energy-momentum tensor vanish forces the string to have the couplings of compactified N=1, D=10 supergravity. In effect, supersymmetry cures the classical infinities.

46125 Representations of affine Kac–Moody algebras and the affine scalar product. Capps, R.H. (Department of Physics, Purdue University, West Lafayette, Indiana 47907 (USA)). *Journal of Mathematical Physics (New York) (USA),* 31(8): 1853-1858 (Aug 1990).

Simple procedures are given for finding all the dominant weights in a highest weight representation of an affine algebra, for finding the Weyl orbit of an arbitrary weight, and for determining whether or not any given weight is in any given representation. A simple definition of congruency is given that applies to all affine algebras. The standard indefinite scalar product is generalized; the generalization is used in the procedures.

46126 Integrability condition and finite-periodic Toda lattice. Okubo, S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627 (USA)). *Journal of Mathematical Physics (New York) (USA),* 31(8): 1919-1928 (Aug 1990). DOE Contract AC02-76ER13065.

A further generalization to construct integrable dynamical systems with hierarchy has been developed, based upon a generalization of the zero Nijenhuis tensor condition in a symplectic manifold with double symplectic structures. As an example, the periodic Toda lattice Hamiltonian has been shown to satisfy these conditions. The case of the three-dimensional Coulomb potential problem has also been analyzed in a similar fashion.

46127 High-order harmonic generation: Simplified model and relevance of single-atom theories to experiment. Sundaram, B. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM (USA)); Milonni, P.W. *Physical Review, A (General Physics) (USA),* 41(11): 6571-6573 (1 Jun 1990).

We present a simple two-state model illustrating the fact that the most prominent features observed in high-order harmonic generation are generic to strongly driven systems. We also address two important questions that arise in the comparison of theory and experiment.

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Refer also to citation(s) 44063, 44442

46128 (DOE/ER/40380–2, pp. 134-141) **Cold fusion.** Koster, J. (North Carolina State Univ., Raleigh (USA)). Hampton Univ., VA (USA). Dept. of Physics. [1989]. (CONF-8905332–: 4. Hampton University graduate studies (HUGS) at the continuous electron beam accelerator facility (CEBAF), Hampton, VA (USA), 30 May - 17 jun 1989). In *HUGS at CEBAF: Proceedings of the Hampton University Graduate Studies at the Continuous Electron Beam Accelerator Facility.* Order Number DE90013957. Source: NTIS, PC A15/MF A01.

In this contribution the author the phenomenom of so-called cold fusion, inspired by the memorable lecture of Moshe Gai on his own search for this effect. Thus much of what follows was presented by Dr. Gai; the rest is from independent reading. What is referred to as cold fusion is of course the observation of possible products of deuteron-deuteron (d-d) fusion within deuterium-loaded (dentended) electrodes. The debate over the two vanguard cold fusion experiments has raged under far more public attention than usually accorded new scientific phenomena. The clamor commenced with the press conference of M. Fleishmann and S. Pons on March 23, 1989 and the nearly simultaneous wide circulation of a preprint of S. Jones and collaborators. The majority of work attempting to confirm these observations has at the time of this writing yet to appear in published form, but contributions to conferences and electronic mail over computer networks were certainly filled with preliminary results. To keep what follows to a reasonable length the author limit this discussion to the searches for neutron (suggested by ref. 2) or for excessive heat production (suggested by ref. 1), following a synopsis of the hypotheses of cold fusion.

46129 (ENEA-RT-FUS–89-09) **A mechanism for neutron emission from deuterium trapped in metals.** Segre, S.E.; Atzeni, S.; Briguglio, S.; Romanelli, F. Rome-2 Univ. (Italy); ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. 15p. (RT/FUS–89-9). Order Number DE90514476. Source: NTIS (US Sales Only), PC A03/MF A01.

Submitted to Europhysics Letters.

This paper describes a hydrogen precipitation based mechanism for neutron production in deuterated metals subjected to thermodynamic transformations implying a decrease of the equilibrium concentration of deuterium in metal. The mechanism involves a series of phenomena which have been observed separately in special cases, but which are technically difficult to detect all together within deuterated transition metals. It is proposed that these phenomena may concur in giving rise to the observed neutron production. The predicted number of neutrons produced appears to be consistent with some of the experiments, but not with others. The proposed mechanism requires that a number of conditions be satisfied: - the initial density of precipitation nuclei must lie within a certain interval, for high density the bubbles are small and do not explode, for low density the total amount of deuterium contained in the cracking bubbles is very small; - the temperature must not be so high as to produce annealing and the consequent elimination of the dislocation nuclei; - the heating time must be short compared with the inter-cavity diffusion time, so the hydrogen diffusion coefficient should not be too large; - electric field, crack dimension and gas pressure should be adequate to ensure electric breakdown and spark formation.

46130 (ENEA-RT-FUS–89-12) **A search for neutron emission from deuterated palladium.** Segre, S.E.; Batistoni, L.;

Bertalot, L.; Bettinali, L.; Martone, M.; Podda, S. Rome-2 Univ. (Italy); ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. 32p. (CONF-8909356–1: Understanding of cold fusion phenomena, Varenna (Italy), 15 Sep 1989; RT/FUS–89-12). Order Number DE90514479. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the understanding of cold fusion phenomena, (Varenna, 15-16 Sep 1989).

A search for neutron emission was performed on deuterated palladium, loaded by gas infusion and subjected to a wide range of thermodynamic transformations and also to some mechanical stresses. No neutrons were observed above and emission rate of about three neutrons per second per gram of metal.

46131 (ENEA-RTI-TIB–89-25) **Fleishmann and Pons experimental electrochemistry: Critical notes.** Casadio, S. ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base. 1989. 39p. (In Italian). (RTI/TIB–89-25). Order Number DE90514514. Source: NTIS (US Sales Only), PC A03.

The electrochemical characteristics of the cathodic process in the experiment of Fleischmann and Ponsare examined and discussed with attention given to hydrogen absorption by the palladium electrode. An assessment is made of the conditions leading to the fusion of deuterum nuclei.

46132 (ENEA-RT-TIB–89-49) **Cold-fusion: A superconducting scheme.** Dattoli, G.; Mari, C.; Carabelas, A.A. ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base. May 1990. 17p. (RT/TIB–89-49). Order Number DE90514532. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Europhysics Letters.

Three recent experiments have focused new attention on 'cold' nuclear fusion. One reported the observation of excess gamma-rays, neutron and 3H from a cell with an anode of Pt, a cathode of Pd and an electrolyte of heavy water with LiOD. The detected gamma-ray spectrum had a pronounced peak at 2.2 MeV and it was suggested that this was due to a n+p nuclear reaction. Neutrons were also observed at about 2.5 MeV with a production rate of $10^{minus20}s^{minus1}$. Furthermore, a sustained and massive heat generation, of the order of 4 MJ/cubic centimeters, was reported. In a similar electrolytic experiment, with an anode of An, a cathode of Pd or Ti and an electrolyte of various salts in heavy water, the detection of neutrons with peak at 2.5 MeV was reported and it was suggested that this was due to D-D fusion. The neutron production rate was of the order of $10^{minus23}s^{minus1}$. In a third case, deuterium gas was put in direct contact with Ti. A neutron flux was observed, thus again suggesting the possibility of a D-D fusion. In attempting to explain these 'cold fusion' phenomena, this note proposes a mechanism for D-D 'cold fusion' in which it is assumed that a local boson field, phi, with a mass 2 m_e and elementary charge 2e, (recently introduced to explain high temperature superconductivity) acts as a catalyst. Also, by introducing a 'modified' Froelich interaction, an investigation is made of the possibility that two deuterium nuclei, strongly interacting with the lattice, form a highly unstable ($10^{minus14}s$) bound state to give interesting fusion rates.

46133 A search for neutrons in single-phase palladium-deuterium. Ehrlich, A.C. (Naval Research Lab., Washington, DC (USA)); Gillespie, D.J.; Kamm, G.N. *Fusion Technology (USA)*, 16(4): 529-531 (Dec 1989).

A palladium rod is charged to relatively high levels of deuterium without passing through the two-phase region of this system. This is accomplished by a combination of gaseous high-temperature-high-pressure initial charging followed by electrolytic charging to a final deuterium/palladium ratio of 0.88. Attempts of detect neutron production during low-temperature thermal cycling and room-temperature slow discharge of deuterium have yielded negative results. Data collected during more rapid discharge of deuterium are statistically unconvincing, but weakly suggestive of some possible neutron production.

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Refer also to citation(s) 44859, 45197, 45914, 45922, 46072, 46204, 46208, 46212, 46213, 46215, 46245, 46258, 46262

46134 (ANU-PRL-TP–89/15) **Two dimensional generalizations of the Newcomb equation.** Dewar, R.L.; Pletzer, A. Australian National Univ., Canberra (Australia). Research School of Physical Sciences. Nov 1989. 22p. Order Number DE90635944. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The Bineau reduction to scalar form of the equation governing ideal, zero frequency linearized displacements from a hydromagnetic equilibrium possessing a continuous symmetry is performed in 'universal coordinates', applicable to both the toroidal and helical cases. The resulting generalized Newcomb equation (GNE) has in general a more complicated form than the corresponding one dimensional equation obtained by Newcomb in the case of circular cylindrical symmetry, but in this cylindrical case , the equation can be transformed to that of Newcomb. In the two dimensional case there is a transformation which leaves the form of the GNE invariant and simplifies the Frobenius expansion about a rational surface, especially in the limit of zero pressure gradient. The Frobenius expansions about a mode rational surface is developed and the connection with Hamiltonian transformation theory is shown. 17 refs.

46135 (ANU-PRL-TP–90/1) **Oscillating magnetic islands in a rotating plasma.** Persson, M. (Australian National Univ., Canberra (Australia). Research School of Physical Sciences); Bondeson, A. Australian National Univ., Canberra (Australia). Research School of Physical Sciences. Jan 1990. 34p. Order Number DE90635945. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The nonlinear evolution of tearing modes in the presence of sheared mass flow is studied as an initial value problem. It is shown that under certain conditions, when the mode is driven unstable primarily by the mass flow, the nonlinear evolution leads to a dynamic state in which the size and shape of the magnetic islands is oscillatory. 15 refs., 11 figs.

46136 (DOE/ER/51124–T1) **High beta and second stability region transport and stability analysis: Technical progress report.** Grumman Aerospace Corp., Princeton, NJ (USA). Corporate Research Center. 12 Jun 1990. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER51124. Order Number DE90016096. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This document summarizes progress made on the research of high beta and second region transport and stability. In the area second stability region studies we report on an investigation of the possibility of second region access in the center of TFTR "supershots." The instabilities found may coincide with experimental observation. Significant progress has been made on the resistive stability properties of high beta poloidal "supershot" discharges. For these studies profiles were taken from the TRANSP transport analysis code which analyzes experimental data. Invoking flattening of the pressure profile on mode rational surfaces causes tearing modes to persist into the experimental range of interest. Further, the experimental observation of the modes seems to be consistent with the predictions of the MHD model. In addition, code development in several areas has proceeded.

46137 (DOE/ER/52127–68) **Alpha ash transport and ash control.** Miley, G.H.; Hu, S.C.; Varadarajan, V. Illinois Univ., Urbana, IL (USA). Fusion Studies Lab. 1990. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. (CONF-9007143–1: ITER burn control meeting, Garching (Germany, F.R.), 9-13 Jul 1990). Order Number DE90015659. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses: thermal α-particle transport is a crucial issue in ash buildup. The transport will determine if buildup prevents ignition and if external control is necessary. Due to uncertainties in the transport coefficients, 1-1/2-D sensitivity study of the influence on the fusion power density is done using the BALDUR code. The Baldur simulations with varying diffusion coefficients for ash plasma are performed. The results of ash transport in the presence of sawteeth and varying edge conditions are discussed. Also, the nature of the fishbone oscillation in the presence of two hot species consisting of hot alphas and beam injected ions is discussed. The sawteeth and fishbones can be potential mechanisms for enhanced ash transport; the latter will indirectly influence the ash transport.

46138 (DOE/ER/53203–4) **Studies of electron cyclotron emission on text: Final report.** Gandy, R.F. Auburn Univ., AL (USA). Dept. of Physics. Jul 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-85ER53203. Order Number DE90015661. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Auburn University electron cyclotron emission (ECE) system has made many significant contributions to the TEXT experimental program during the past five years. Contributions include electron temperature information used in the following areas of study: electron cyclotron heating (ECH), pellet injection, and impurity/energy transport. Details of the role which the Auburn ECE system has played will now be discussed.

46139 (DOE/ER/53223–129) **Control of alpha particle transport using spatially inhomogeneous ion cyclotron resonance heating in a tokamak with general flux surface geometry: Revised.** Chang, C.S. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences); Imre, K.; Weitzner, H. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences; International Atomic Energy Agency, Vienna (Austria). 16 Apr 1990. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53223. (IAEA-CN–53;CONF-901025–1: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE90013294. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Short communication. CHARGED-PARTICLE TRANSPORT/ control; ALPHA PARTICLES/charged-particle transport; CONTROL; ICR HEATING; TOKAMAK DEVICES

46140 (DOE/ER/53242–4) **Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-wave heating: Progress report No. 4, July 16, 1989–November 15, 1989.** Ribe, F.L.; Nelson, B.A. Washington Univ., Seattle, WA (USA). [1989]. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER53242. (UWAERP–23). Order Number DE90016122. Source: NTIS, PC A04/MF A01; OSTI; INIS.

This paper discusses induced axial current studies in a hardcore Theta-Pinch; nonaxisymmetric RF heating of a high-Beta plasma column; formation of Axisymmetric hardcore theta pinches with notched hardcore current; and externally driven till made experiments on the high-beta Q machine field reversed configuration. (LSP)

46141 (DOE/ER/53252–20) **1-D RFP [Reversed Field Pinch] plasma simulations with interchange turbulence driven transport.** Veerasingam, R. Pennsylvania State Univ., University Park, PA (USA). Dept. of Nuclear Engineering. 1 Aug 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER53252. Order Number DE90015856. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In this writeup, we present the results of simulations using anomalous thermal transport coefficients for Reversed Field Pinch RFP's derived from saturated resistive interchange ("g-mode") turbulence. The driving mechanism for the transport coefficient is the pressure gradient. The derivation of the thermal transport coefficients from the energetics of interchange turbulence is described in the references. The code that we use for these simulations is RFPBI, a RFP plasma transport code that includes a coronal non equilibrium treatment of impurities. For these simulations, no impurities are included. 5 refs., 4 tabs.

46142 (DOE/ER/53263–9) **Fundamental studies of fusion plasmas: Annual performance report.** Aamodt, R.E.; Catto, P.J.; D'Ippolito, D.A.; Myra, J.R.; Russell, D.A. Lodestar Research Corp., Boulder, CO (USA). Mar 1990. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER53263. (LRC–90-16). Order Number DE90015732. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses tokamak transport, auxiliary heating physics; ICRF impurity study; ponderomotive stabilization studies; ICRF induced fluxes in the edge plasma; runaway electron confinement in TEXT; rf sheath modelling for ICRF antenna Faraday screens; and isotropic energetic in fluxes in tokamaks. (LSP)

46143 (DOE/ET/51013–283) **Lectures in plasma diagnostics.** Hutchinson, I.H. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. Jun 1990. 59p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (CONF-900739–2: 4. Latin American workshop on plasma physics, Buenos Aires (Argentina), 16-27 Jul 1990; PFC/CP–90-1). Order Number DE90015825. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following topics on plasma diagnostics: Electric probes in flowing and magnetized plasmas; Electron cyclotron emission absorption; Magnetic diagnostics; Spectroscopy; and Thomson Scattering.

46144 (DOE/ET/51013–284) **TSC [Tokamak Simulation Code] simulations of Alcator C-MOD discharges: 3, Study of axisymmetric stability.** Ramos, J.J. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. Jun 1990. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-78ET51013. (PFC/RR–90-9). Order Number DE90015386. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The axisymmetric stability of the single X-point, nominal Alcator C-MOD configuration is investigated with the Tokamak Simulation Code. The resistive wall passive growth rate, in the absence of feedback stabilization, is obtained. The instability is suppressed with an appropriate active feedback system. 2 refs., 25 figs., 1 tab.

46145 (ENEA-RT-FUS–89-11) **Contributions to the 13th conference on the numerical simulation of plasmas (Santa Fe', 17-20 Sep 1989).** ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. 11p. (CONF-8909354–Exc.: 13. conference on the numerical simulation of plasmas, Santa Fe, NM (USA), 17 Sep 1989). Order Number DE90706132. Source: NTIS (US Sales Only), PC A03/MF A01.

Individual papers are processed separately for the data base. (DLC)

46146 (ETDE-IT–90-25) **Quasi-linear absorption of LH waves by fusion generated alpha particles.** Barbato, E.; Santini, F. ENEA, Frascati (Italy). Centro Ricerche Energia. 1989. 31p. Order Number DE90514498. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Nuclear Fusion.

Lower hybrid waves are foreseen to be used in a steady state reactor to produce current and control the current profile and the stability of internal modes. In the ignited phase, however, the presence of energetic alpha-particles may prevent wave-electron interaction, thus reducing the current drive efficiency. This is due to the very high birth energy of the alpha-particles that may absorb the lower hybrid wave power to a large extent. This unfavourable effect is absent at high frequencies (greater than or equal to GHz for typical reactor parameters). Nevertheless, due to the technical difficulties of using such high frequencies, it is very important to investigate whether alpha-particle absorption would be negligible also at relatively lower frequencies. In this paper, such a study is carried out on the basis of the quasi-linear theory of wave-alpha interactions by calculating the quasi-linear alpha distribution function and the related absorption. The model for alpha-particles is then coupled to a 1-D deposition code for lower hybrid waves to calculate the competition in the absorption between alphas and electrons as the waves propagate into the plasma core for typical reactor (ITER) parameters.

46147 (ETDE-IT–90-31) **On the stability of internal kink modes with energetic trapped particles.** Romanelli, F.; Chen, Liu; White, R.B. ENEA, Frascati (Italy). Centro Ricerche Energia. 1989. 54p. Order Number DE90514507. Source: NTIS (US Sales Only), PC A04/MF A01.

Published on Nuclear Fusion.

This paper deals with a comprehensive theoretical analysis on the stability of ideal internal kink modes in present-day high temperature tokamaks. The theory thus includes kinetic effects associated with energetic trapped particles, bulk ion diamagnetic drifts, as well as transit resonances. A corresponding dispersion relation is derived and analyzed both analytically and numerically. The roles and implications of various kinetic effects are then delineated and comparisons with previously obtained results are also made.

46148 (ETDE-IT–90-46) **Toroidal ion temperature gradient driven stability in a multispecies plasma.** Paccagnella, R.; Briguglio, S.; Romanelli, F. ENEA, Frascati (Italy). Centro Ricerche Energia. Jul 1989. 15p. Order Number DE90514521. Source: NTIS (US Sales Only), PC A03/MF A01.

Published on Nuclear Fusion.

For typical tokamak parameters, the driving effect of curvature is stronger than the effect of parallel compressibility. Most of the analyses on this instability deal with pure plasmas, while little effort has been devoted in understanding the role of impurities. In this paper, the effect of an impurity ion species on the stability of the toroidal ion temperature gradient driven mode is investigated by the use of kinetic ion response. The results are generalized to include moderately peaked density profiles and trapped electron dynamics. It is found that impurities stabilize the mode in the flat density limit, due to the increased dilution, or destabilize the mode, for moderately peaked density profiles, due to the resonance with the magnetic drift frequency .

46149 (ETDE-IT–90-52) **Lower hybrid parametric instabilities in the FT plasma.** Cardinali, A.; Cesario, R.; Paoletti, F. ENEA, Frascati (Italy). Centro Ricerche Energia. 1988. 18p. Order Number DE90514527. Source: NTIS (US Sales Only), PC A03/MF A01.

In Alcator C 4.5 GHz and FT (Frascati Tokamak) 2.45Ghz lower hybrid (LH) experiments, secondary peaks were always observed after a strong spectral line broadening around the frequency of the injected rf power as the density was increased. During the FT 8.00GHz experiment, fast ion tails were not observed but in some high density discharges, with no evidence of electron heating, only a strong line broadening was observed. The rf probe activity was strongly dependent on theedge plasma parameters. Strong line broadening and higher secondary peak levels were observed in increasing the local density and decreasing temperature. Some mechanisms such as scattering fluctuation or parametric instabilities are proposed in order to explain the line frequency broadening. The first of these implies multiple scattering processes of the LH wave involving all the plasma column and it provides a spectral broadening increasing with plasma temperature. Such a behaviour seems to be in contrast with the FT rf probe observations in which large line broadening becomes relevant in cold plasmas and in high density regimes. When the broadening occurs, no effect of the rf on the plasma bulk is observed.

46150 (EUR-CEA-FC–1374) **Runaway-ripple interaction in Tokamaks.** Laurent, L.; Rax, J.M. Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee. Aug 1989. 19p. Source: NTIS (US Sales Only), PC A03/MF A01.

Two approaches of the interaction between runaway electrons and the ripple field, in tokamaks, are discussed. The first approach considers the resonance effect as an intense cyclotron heating of the electrons, by the ripple field, in the guiding center frame of the fast particles. In the second approach, an Hamiltonian formalism is used. A criterion for the onset of chaotic behavior and the results are given. A new universal instability of the runaway population in tokamak configuration is found. When combined with cyclotron losses one of its major consequence is to act as an effective slowing down mechanism preventing the free fall acceleration toward the synchrotron limit. This configuration allows the explanation of some experimental results of Tore Supra and Textor.

46151 (GA-A–15820) **rf heating in Doublet IIA.** Luxon, J.L.; Freeman, R.L.; Chan, V.S.; Chiu, S.C.; DeBoo, J.C.; Harvey, R.W.; Jensen, T.H.; La Haye, R.J.; Lohr, J.M.; Moeller, C.P.; Ohkawa, T.; Riordan, J.C.; Tooker, J.F.; Vaslow, D.F. General Atomics, San Diego, CA (USA). Mar 1980. 89p. Sponsored by U.S. DOE Energy Research. DOE Contract AT03-76ET51011. Order Number DE90016206. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report summarizes the results of the rf heating experiments in Doublet IIA. The experiments were designed to heat electrons using rf power at about twice the lower hybrid frequency. The parallel index of refraction was chosen in the range of $11 < n_{\parallel} < 28$ for optimal deposition of power in the central regions of the plasma. Up to 500 kW of power at 800 and 915 MHz was applied to circular discharges with typical ohmic powers of 100 kW. The rf power was efficiently coupled to the plasma as the desired slow wave. Power was transferred to the charged particles, but the additional energy was poorly confined. The energy loss to the walls was observed using particle energy flux measurements. Both high energy electron and ion tail components were produced, and heating in the electron bulk was only sporadically observed. Two possible mechanisms for the heating and energy loss are presented: first, the power was coupled to the energetic electrons via Landau damping and lost by anomalous transport before it was thermalized. Second, the rf power was coupled to energetic ions and lost to the walls by particle orbit losses.

46152 (GA-A–20000) **CART manual.** Lee, J.K. (General Atomics, San Diego, CA (USA)); Chu, M.S.; Howl, W.L.; Lao, L.L.; Turnbull, A.D.; Klasky, M. General Atomics, San Diego, CA (USA). Aug 1990. 84p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER53277. Order Number DE90014884. Source: NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

A brief description of the numerics and physics of the 3-D resistive magnetohydrodynamic initial value code CART is provided. Instructions for running the code on the MFE Crays are given as well as descriptions of the required input files and data.

46153 (JET-R–89-17) **An investigation of the applicability of a JxB type current drive in tokamaks.** Liley, B.S. Commission of the European Communities, Abingdon (UK). JET Joint Undertaking. 1989. 32p. Order Number DE90635930. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

Previous theoretical work on JxB current drives is briefly reviewed. Two separate cases are identified. The first is one in which the travelling wave propagates perpendicular to the steady state magnetic field and the second is for the situation in which propagation is parallel to a significant component of the steady state field. For the first case, field penetration and synchronous electron motion is possible. The second case is investigated by considering in detail an m=0 type mode for tokamak parameters, ion motion being taken into account. It is found that neither synchronous motion nor field penetration occurs. Since it is this latter case which is appropriate to tokamaks, these being characterised by the major current flow being parallel to the field, it is concluded that the JxB type current drive has no application in high temperature tokamak devices. (author).

46154 (LA-UR–90-2864) **Tilt stability and compression heating studies of field-reversed configurations.** Rej, D.J. (Los Alamos National Lab., NM (USA)); Tuszewski, M.; Barnes, D.C.; Barnes, G.A.; Chrien, R.E.; Siemon, R.E.; Taggart, D.P.; Webster, R.B.; Wright, B.L.; Milroy, R.D.; Crawford, E.A.; Slough, J.T.; Steinhauer, L.C.; Bailey, A.D.; Baron, M.H.; CobbLos Alamos National Lab., NM (USA). [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-901025–2: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE90016443. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The first observations of internal tilt instabilities in field-reversed configurations (FRCs) are reported. Detailed comparisons with theory establish that data from an array of external magnetic probes are signatures of these destructive plasma instabilities. This work reconciles theory and experiments and suggests that grossly stable FRCs are restricted to very kinetic and elongated plasmas. Self-consistent three-dimensional numerical simulations demonstrate tilt stabilization by the addition of a beam ion component. High-power compression heating experiments with stable equilibrium FRCs are also reported. Plasmas formed in a tapered theta-pinch coil have been translated along a guide magnetic field into a new single-turn compression coil where the external field is increased up to 7 times the initial value in 55 μs. Substantial heating is observed accompanied by a decrease in confinement time. 17 refs.

46155 (LA-UR–90-2868) **Confinement studies in the ZT-40M reversed field pinch.** Weber, P.G. (Los Alamos National Lab., NM (USA)); Schoenberg, K.F.; Ingraham, J.C.; Miller, G.; Moses, R.W.; Munson, C.P.; Nebel, R.A.; Pickrell, M.M.; Wurden, G.A.; Tsui, H.Y.W.; Ritz, Ch.P.; Veerasingham, R.; Klevans, E.; Ellis, R.F. Los

Alamos National Lab., NM (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-901025–3: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (USA), 1-6 Oct 1990). Order Number DE90016442. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Measurement of electrostatic and magnetic fluctuations in the ZT-40M Reversed Field Pinch (RFP) are used to estimate fluctuation driven transport. Edge electrostatic fluctuations appear to explain edge particle transport, analogously to some tokamak and stellarator observations. However, in contrast to tokamaks, electrostatic fluctuations do not explain the heat flux through the edge. Instead, transport of suprathermal electrons along fluctuating magnetic field lines constitute the major electron heat loss. Ion losses in ZT-40M appear to be dominated by charge exchange.

46156 (LRP–403/90, pp. 5-8) **Influence of triangularity and profiles on ideal-MHD beta limits for NET.** Schultz, G. (Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland)); Bondeson, A.; Troyon, F.; Roy, A. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Jun 1990. (CONF-900602–: 17. European conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Papers contributed to the 17th EPS conference on controlled fusion and plasma heating, Amsterdam, The Netherlands, June 1990.* Order Number DE90706116. Source: NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS.

Ideal-MHD stability calculations are presented to show the effect of triangularity δ on the beta-limit for plasma of NET/ITER type with ellipticity κ=2 and aspect ratio A=3.7. The optimum betas are achieved as a tradeoff between n=1 ideal kink stability and stability against Mercier and ballooning (n=∞) modes. Two different types of beta-optimisations have been made to study the influence of equilibrium profiles. In one set of optimisations, the current profile is prescribed and the pressure profile is optimised. We impose current profiles that are flat in the central region and decrease monotonically to zero at the edge. For such current profiles, maximum beta is obtained for broad pressure profiles, in particular, for low q_a and small triangularity. The beta-limit is independent of triangularity up to δ=0.4, but increases slightly for high triangularity, δ=0.6. In the other set of optimisations, we specify a more peaked pressure profile and optimise the current profile. Peaked pressure profiles, when combined with standard current profiles, for which the central q is flat and near unity, tend to be unstable to localised, pressure driven modes. Therefore, careful tailoring of the central current profile is required. After optimisation of the current profile the n=1 and n=∞ modes give a beta-limit for peaked pressure profiles that is almost unchanged from that for broad profiles, if the cross-section is sufficiently triangular, $\delta \geq 0.4$. By contrast, in an elliptical cross-section, δ=0.0, the maximum beta decreases significantly for the peaked profiles. (author) 3 refs., 3 figs.

46157 (LYCEN–89-02 C.11.1-C.11.21) **Muon catalyzed fusion.** Petitjean, C. (Paul Scherrer Inst. (PSI), Wuerenlingen (CH)). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1989. (CONF-8903172–: 10. Biennial studies session on nuclear physics, Aussois (France), 6-10 Mar 1989). In *Biennial studies of nuclear Physic.* Order Number DE90514570. Source: NTIS (US Sales Only), PC A17/MF A01.

Muon catalyzed fusion or cold fusion has become a research topic of great new interest. Due to a resonance mechanism in dμt mesic molecule formation, fusion yields exceeding 100 per muon were observed in experiments at LAMPF and PSI. $\mu\alpha$ sticking after dt fusion seems presently to be the main limitation of fusion output. An introduction to this field is given and recent development in theory and experiments presented. The kinetics of the dμt cycle is rather complex and poses several open questions with respect to muon transfer, mesic molecule formation and sticking. Recent measurements show the temperature and density dependence of fusion rates. The results for sticking are somewhat controversial and indicate lower values than theoretically expected. Reactivation of the $\mu\alpha$ system may be the crucial process to reduce sticking. Several schemes of possible future exploitation are discussed.

46158 (PCCF-T–88-08) **Contribution to the electron density diagnostics of a plasma by means of three-wave interferometry.** Says, L.P. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1988. 106p. (In French). Order Number DE90514633. Source: NTIS (US Sales Only), PC A06/MF A01.

Plasma use can be considered as an acceleration technique but a high precision diagnostic is necessary. This can be provided by refractive index determination. A three wave interferometer gives an accuracy in the range of a few nanometers in optical path measurements. Such an apparatus has been designed, built and tested on a discharge plasma, previously diagnosed by conventional methods. Results are in good agreement and the expected accuracy is achieved.

46159 (PPPL–2708) **Issues in tokamak/stellarator transport and confinement enhancement mechanisms.** Perkins, F.W. Princeton Univ., NJ (USA). Plasma Physics Lab. Aug 1990. 66p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90014821. Source: NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

At present, the mechanism for anomalous energy transport in low-β toroidal plasmas – tokamaks and stellarators – remains unclear, although transport by turbulent E x B velocities associated with nonlinear, fine-scale microinstabilities is a leading candidate. This article discusses basic theoretical concepts of various transport and confinement enhancement mechanisms as well as experimental ramifications which would enable one to distinguish among them and hence identify a dominant transport mechanism. While many of the predictions of fine-scale turbulence are born out by experiment, notable contradictions exist. Projections of ignition margin rest both on the scaling properties of the confinement mechanism and on the criteria for entering enhanced confinement regimes. At present, the greatest uncertainties lie with the basis for scaling confinement enhancement criteria. A series of questions, to be answered by new experimental/theoretical work, is posed to resolve these outstanding contradictions (or refute the fine-scale turbulence model) and to establish confinement enhancement criteria. 73 refs., 4 figs., 5 tabs.

46160 (PPPL–2713) **Beta optimization in the context of reactor relevant tokamaks.** Manickam, J. Princeton Univ., NJ (USA). Plasma Physics Lab. Aug 1990. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90016045. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In a reactor relevant tokamak the appropriate definition of β, the ratio of the particle and magnetic field pressures, is $\beta^* \equiv [2 < p^2 >^{\frac{1}{2}} / B^2]$, which exceeds the conventional definition by a factor dependent on the pressure peaking factor, PPF. A simple scaling is obtained which relates the two definitions, $\beta^*/\beta \simeq 0.9 + 0.15$ PPF. Stability properties are determined in terms of β^* in a circular and dee-shaped tokamak. 4 refs., 6 figs.

46161 (PPPL–2715) **Finite pressure effects on sawtooth oscillation.** Park, W.; Monticello, D.A.; Fredrickson, E.; McGuire, K. Princeton Univ., NJ (USA). Plasma Physics Lab. Aug 1990. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90015871. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Nonlinear 3-D simulation of sawtooth oscillations shows that the helically twisted hot spot has a prominent toroidal bulge at the large major radius side, characteristic of a high $\epsilon\beta_p$ instability. This bulge drives other m/n islands just outside the mixing radius resulting in a stochastic annular region. A similar effect is also found in shaped plasmas, even at low β. These effects agree with experimental data, giving detailed support to the Kadomtsev reconnection model. This effect can also be used to explain the experimental sawtooth heat pulse 'anomaly.' At very high $\epsilon\beta_p$, the stochastic region can essentially fill the whole plasma, and can result in a 'high β disruption.' 16 refs., 6 figs.

46162 (PSC–2) **On hydrodynamics of collisionless relativistic plasma in a strong magnetic field.** Lominadze, J.G. (AN Gruzinskoj SSR, Abastumani (USSR). Abastumanskaya Astrofizicheskaya Observatoriya); Javakhishvili, J.I.; Tsikarishvili, E.G. Nagoya

Univ. (Japan). Plasma Science Center. Nov 1989. 14p. Order Number DE90513926. Source: NTIS (US Sales Only), PC A03/MF A01.

The paper presents a closed set of hydrodynamical equations based on a relativistic kinetic equation. This set of equations describes relativistic strongly magnetized plasma with an anisotropic pressure tensor. Such a model was suggested previously by Chew, Goldberger and Low for nonrelativistic plasma. Here, the main macroscopic parameters in the relativistic theory are determined based on a relativistic kinetic equation. Then, a closed system of hydrodynamic equations for relativistic collisionless plasma is derived. Thus, it is shown that a closed set of hydrodynamical equations for collisionless relativistic plasma in a strong magnetic field can be formulated. Such a strong magnetic field leads to anisotropy of macroscopic parameters of the plasma. The equations obtained are rather complicated, though analogous to those derived from the nonrelativistic theory. The difference is that the relativistic theory requires a larger number of parameters to describe the plasma: instead of the six unknown quantities in the nonrelativistic case, nine quantities are necessary in the relativistic case. (N.K.).

46163 (SAND–90-1959C) **Disruption runaway modeling, ripple effects and energy limits.** Russo, A.J. Sandia National Labs., Albuquerque, NM (USA). 18 Jul 1990. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-9007138–1: Meeting on vertical displacement events and disruption generated runaway electrons, Garching (Germany, F.R.), 23-25 Jul 1990). Order Number DE90015164. Source: NTIS, PC A03/MF A01; OSTI; INIS.

Several models of runaway electron generation during a disruption are described and applied to the problem of determining the radiation loss and energy limit of runaway electrons. In particular the prediction of orbits and energy limits for proposed ITER design are discussed. It was found that resonance between the electron gyrofrequency and the fundamental ripple frequency can lead to large synchrotron radiation losses and create an upper bound on runaway energy. Interactions with the second harmonic of the ripple field are very sensitive to ripple amplitude and may lead to a further reduction in runaway energy. In ITER this effect can limit the runaway energy to values of 270 MeV. A lump circuit model of the plasma can be used to determine the coupled interactions of the runaway currents with the plasma and control circuit currents. Depending on what is assumed about the perpendicular energy of the runaway electrons. Maximum values of runaway energy predicted for ITER are in the range of 35 to 120 MeV. 4 refs., 15 figs.

46164 (UCRL-CR–104449) **UCD-LLNL collaboration on basic plasma physics research in inertial confinement fusion: Final report.** Mizuno, K. (California Univ., Davis, CA (USA)); De Groot, J.S.; Young, P.; Drake, P.; Estabrook, K. Lawrence Livermore National Lab., CA (USA). Jul 1990. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015771. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have made extensive studies of the Ion Acoustic Decay Instability (IADI) in laser-produced plasmas using the Janus (Phoenix) laser at LLNL. We found that the threshold is quite low and that, in planar plasmas, it can be reduced to homogeneous-plasma, collisional values. These observations are consistent with the plasma-density profiles calculated by hydrodynamic simulations using the LASNEX computer code run with a flux limiter of f = 0.1. We have designed experiments to study the IADI in larger plasmas using the Nova laser.

46165 (UCRL-JC–103919) **X-ray spectroscopy of high-Z ions.** Beiersdorfer, P. Lawrence Livermore National Lab., CA (USA). [1990]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900757–3: 15. international conference on x-ray and inner-shell processes, Knoxville, TN (USA), 9-13 Jul 1990). Order Number DE90015618. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

X-ray spectroscopy is a tool of choice for studying the properties of high-Z ions and provides valuable data to test atomic models, excitation cross section and atomic structure calculations. Measurements are presented of highly charged heliumlike and neonlike ions from tokamak observations and the electron beam ion trap at Livermore which illustrate unresolved questions of atomic physics and state-of-the-art approaches to address the issues. 17 refs., 8 figs., 3 tabs.

46166 (UCRL-JC–104241) **Electromagnetic particle codes on unstructured grids.** Ambrosiano, J.J. (Lawrence Livermore National Lab., CA (USA)); Brandon, S.T.; Loehner, R. Lawrence Livermore National Lab., CA (USA). Jun 1990. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006195–7: Free Lagrange conference, Jackson Lake, WY (USA), 3-7 Jun 1990). Order Number DE90015187. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The most widely used computational model of collisionless plasmas is the Lagrangian-Eulerian hybrid technique known as particle-in-cell or PIC. In the electromagnetic version, Maxwell's equations are solved on an Eulerian grid and electromagnetic forces are interpolated form the grid to particle locations. Particles are then moved in Lagrangian fashion while their currents are interpolated back onto the grid to provide sources for the fields on the next cycle. There are many applications where one needs to model plasmas and electromagnetic waves inside regions of complicated shape. Traditional methods for solving Maxwell's equations employ finite differences on regular grids to replace differential operators. These methods are awkward for complicated boundary shapes, often replacing smoothly curved or slanted boundaries with stairsteps. The desire to incorporate realistic boundaries into plasma simulations is motivated by a host of situations in which proper representation of the boundary shape is expected to be critical. Our approach to solving this problem is to design electromagnetic particle codes based on the use of unstructured grids. The arbitrary connectivity of unstructured grids provides the flexibility to place nodes wherever needed to fit the most complex boundary shapes. The most significant problems that must be addressed as a result of this strategy are: grid generation, field solution, and particle tracking. Our solutions to these problems, along with a few preliminary results, are presented in this paper. 10 refs., 6 figs.

46167 (UCRL-JC–104606) **Experimental observations of nonlinear effects in laser-plasma interactions.** Baldis, H.A. (National Research Council of Canada, Ottawa, ON (Canada)); Young, P.E. Lawrence Livermore National Lab., CA (USA). 20 Jul 1990. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007136–2: 1990 summer workshop on nonlinear and chaotic phenomena in plasmas, solids, and fluids, Edmonton (Canada), 16-27 Jul 1990). Order Number DE90015195. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Understanding the growth and saturation of parametric instabilities in laser-produced plasmas requires knowledge of the nonlinear properties of the instabilities and their interaction with each other. Nonlinear behavior of parametric instabilities, which are usually associated with unique optical features, have been evidenced in numerous experiments on a variety of laser facilities. We will discuss four examples of nonlinear behavior in laser-produced plasmas: (1) nonlinear stimulated Brillouin scattering spectra, (2) suppression of stimulated Raman scattering by stimulated Brillouin scattering, (3) the parametric decay instability and the onset of turbulence, and (4) the transition to "bursting" behavior of the two-plasmon decay instability. We also discuss experiments that demonstrate the nonlinear propagation of laser light through a plasma and the nonlinear effects which occur as a consequence. 49 refs.

46168 **Modeling of post-breakdown phenomena.** Root, R.G. (Sparta, Inc., Lexington, MA (USA)). pp. 69-104 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper describes the types of plasmas observed when a pulsed laser strikes a material. The author describes the qualitative features of these plasmas and models of the plasma types are offered.

46169 **Physics of laser-induced breakdown: An update.** Weyl, G.M. (Physical Sciences, Inc., Andover, MA (USA)). pp. 1-68 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper presents the state of understanding of laser-induced breakdown in solids, liquids, and gases. The author defines laser-induced breakdown as the generation, by the end of the pulse, of a practically totally ionized gas (plasma) and states that the experimental criterion that is generally used is the observation of a glow or flash in the focal region.

46170 Laser-sustained plasmas. Keefer, D.R. (Tennessee Univ., Tullahoma, TN (USA). Space Inst.). pp. 169-206 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper discusses the continuous, laser-sustained plasma (LSP) that is referred to as a continuous optical discharge (COD). The author reports that it has a number of unique properties that make it an interesting candidate for a variety of applications. The author concludes that there are several advantages of the LSP for spectrochemical analysis.

46171 Introduction to laser plasma diagnostics. Hauer, A.A. (Los Alamos National Lab., NM (USA)); Baldis, H.A. pp. 105-168 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper discusses laser plasma diagnostics. The authors focus on work that has been done over the last six years and on the underlying physical principles of measurement techniques as opposed to instrumentation.

46172 Inertially confined fusion. McCrory, R.L. (Rochester Univ., NY (USA). Lab. for Laser Energetics); Soures, J.M. pp. 207-268 of Laser-induced plasmas and applications. Radziemski, L.J.; Cremers, D.A. Marcel Dekker Inc., New York, NY (USA) (1989).

This paper addresses the issues related to high-performance targets and obtains an extensive database to determine the accuracy of multidimensional code calculations. According to the authors, these experiments, along with the numerical simulations, enhance understanding of the effects of nonuniformities on ablatively driven, direct-drive, laser-fusion targets.

46173 Laser plasmas for chemical analysis. Cremers, D.A. (Los Alamos National Lab., NM (USA)); Radziemski, L.J. pp. 351-415 of Laser spectroscopy and its applications: Volume 11. Radziemski, L.J.; Solarz, R.W.; Paisner, J.A. Marcel Dekker Inc., New York, NY (USA) (1987).

This paper describes some recent uses of laser plasmas for chemical analysis and reviews established applications. The discussion of pulsed laser plasmas is divided into two main sections according to whether the spark plasma is used only to ablate material from a sample for analysis by an auxiliary technique or whether the spark plasma is analyzed directly (direct spark analysis). Particular emphasis is placed on the analytical results and figures of merit for each method.

46174 Improved energy confinement in spheromaks with reduced field errors. Wysocki, F.J. (Los Alamos National Laboratory, Los Alamos, NM (USA)); Fernandez, J.C.; Henins, I.; Jarboe, T.R.; Marklin, G.J. *Physical Review Letters (USA),* 65(1): 40-43 (2 Jul 1990).

An increase in the global energy confinement time (τ_E) was obtained in the CTX spheromak by replacing the high-field-error mesh-wall flux conserver with a low-field-error solid-wall flux conserver. The maximum τ_E is now 0.18 ms, an order of magnitude greater than previously reported values of $\lesssim$0.017 ms. Both τ_E and the magnetic energy decay time (τ_W) now increase with central electron temperature, which was not previously observed. These new results are consistent with a previously proposed energy-loss mechanism associated with high edge helicity dissipation.

46175 The media event. Zorpette, G. *IEEE Spectrum (Institute of Electrical and Electronics Engineers) (USA),* 27(2): 23 (Feb 1990).

The author discusses the controversy surrounding cold fusion. Issues regarding U.S. funding of future investigations of this phenomena are addressed.

46176 Measurement of the effects of Faraday shields on ICRH antenna coupling. Kwon, M. (Georgia Inst. of Tech., Atlanta, GA (USA). Nuclear Engineering Dept.); Thomas, C.E. Jr.; Hoffman, D.J.; Shepard, T.D.; Rettig, C.L. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 184-189 (Apr 1990). DOE Contract AC05-84OR21400.

Compact loop antennas are being applied to several fusion experiments. Although individual configurations vary, all of these antennas generally comprise a current strap in a recessed box and a Faraday shield. The effect of the cross-sectional shape of the current strap on voltage and current levels was measured. In this work the coupling characteristics of cavity antennas that have current straps with the previously evaluated cross-sectional shapes re tested with several Faraday shields. Impedances and relative fields are measured for various combinations of the current strap and Faraday shield. The experiments show that the fractional reduction in the magnetic flux linkage to the plasma resulting from the addition of any particular Faraday shield i virtually independent of the shape of the current strap. This is true in spite of the fact that the same mechanism which is responsible for the reduction in flux is also responsible for a significant redistribution of the antenna current on the current strap. Thus the process of optimizing antennas is reduced to that of separately optimizing the current strap and Faraday shield.

46177 Time-dependent numerical simulation of ablation-controlled arcs. Gilligan, J.G. (North Carolina State Univ., Raleigh, NC (USA). Dept. of Nuclear Engineering); Mohanti, R.B. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 190-197 (Apr 1990).

Ablation-controlled arcs (ACAs) are a particular type of high-density ($\sim 10^{26}$ m$-$ 3), low-temperature ($\sim$3 eV) arc used as switches and for acceleration applications. The wall material under high heat flux will usually lead to ablation and energy loss by axial convection transport in a cylindrical geometry. A zero-dimension (0-D) time-dependent code (ZEUS) has been developed to simulate ACA behavior. The code includes energy transport, equation-of-state, and electrical resistivity models. Particular attention is given to the equation-of-state and the determination of the charged state of multicomponent plasma under LTE conditions. The 0-D model is self-consistently solved by a fourth-order method. The numerical simulation of ZEUS was compared against both experimental and other theoretical results.

46178 Technical notes. Earley, L.M. (Sandia National Labs., Albuquerque, NM (USA)); Scott, G.L. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 247-248 (Apr 1990). DOE Contract AC04-76DP00789.

A miniature laser-triggered high-voltage vacuum switch with a fused KCl and Ni cathode has been developed. The switch uses metal-ceramic construction with a sapphire window in the anode to allow the laser beam to strike the cathode surface. Reliable triggering is achieved with only 20 μJ of laser energy. The switch was operated with a gap voltage ranging from 500 V to 3 kV, with switching currents up to a 5-Ka peak. Switch life greater than 1000 shots without performance degradation has been observed on 50 prototype devices. The function time of the switch varies from 10 $\pm$ 1 ns at 3 kV to 100 $\pm$ 50 ns at 500 V.

46179 A direct solution for the efficiency and gain of a CARM oscillator. Parks, P.B. (General Atomics Inc., Theoretical Science Div., San Diego, CA (US)). *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 223-227 (Apr 1990).

Approximate analytic solutions for the resonant interaction of a relativistic electron beam interacting with a constant amplitude TEM wave, as in the cyclotron autoresonance maser (CARM) oscillator configuration, are presented. The approximation neglects force bunching relative to inertial bunching, which is usually valid for CARM parameter values of interest in many applications.

46180 A model for the shell current in a reversed field pinch. Greene, P.A. (Colorado Univ., Boulder, CO (USA). Dept. of Physics); Robertson, S.H. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 228-230 (Apr 1990).

A model is presented for the current in a resistive shell in a reversed field pinch (RFP). The model is compared to experimental measurements. The model is applied to experiments performed on

the Reversatron II RFP and is shown to provide an approximate description of the shell current. This model provides a means for including the effect of the shell in the design of feedback control systems that may be used on existing or future RFP's having resistive shells.

46181 Modeling the propagation of long, intense microwave pulses in mixtures of air and SF_6. Khanaka, G.H. (Lawrence Livermore National Lab., CA (USA)); Yee, J.H.; Mayhall, D.J. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 210-213 (Apr 1990). DOE Contract W-7405-ENG-48.

The authors have used a set of self-consistent equations to study the interaction of long, intense microwave pulses with gases. They found that the threshold for breakdown is a factor of seven higher in SF_6 than in air. This difference is attributed to the fact that SF_6 is an insulator. When SF_6 was mixed with air, the breakdown threshold increased with the increase in the percentage of SF_6. Introducing 5–10% of SF_6 in air increased the breakdown threshold by a factor of 3–4. The electron density and conductivity and the plasma frequency increased as the pulse intensity increased. The growth rates of the electron density and conductivity were much higher in air than in SF_6.

46182 A two-component model for the electron distribution function in a high-current pseudospark or back-lighted thyratron. Bauer, H.R. (Dept. of Electrical Engineering, Univ. of Southern California, SSC 420, Los Angeles, CA (US)); Kirkman, G.; Gundersen, M.A. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 18(2): 237-246 (Apr 1990).

Temperature, energy, and densities of two electron distribution function components, including an isotropic bulk part and an anisotropic beam, are analyzed for a hydrogen pseudospark and/or black-lighted thyratron switch plasma with a peak electron density of 1–3 $\times$ 10^{15} cm^{-3} and peak current density of $\approx$ 10^4 A/cm^2. Collisional and radiative processes of monoenergetic beam electrons, bulk plasma electrons and ions, and atomic hydrogen are modeled by a set of rate equations, and line intensity ratios are compared with measurements. Under these high-current conditions, for an initial density n_{H2} = 10^{16} cm−3 the evaluated bulk plasma parameters are an electron density of 1–3 $\times$ 10^{15} cm−3 and electron temperature of 0.8–1 eV; the estimated beam density is $\approx$ 10^{13}–10^{14} cm−3. These results suggest the possibility of producing in a simple way a very high-density electron beam.

46183 Experimental evidence for coupling of plasma particle and heat transport in the TEXT tokamak. Brower, D.L. (Fusion Research Center, University of Texas, Austin, Texas 78712 (USA)); Kim, S.K.; Wenzel, K.W.; Austin, M.E.; Foster, M.S.; Gandy, R.F.; Luhmann, N.C. Jr.; McCool, S.C.; Nagatsu, M.; Peebles, W.A.; Ritz, C.P.; Yu, C.X. *Physical Review Letters (USA),* 65(3): 337-340 (16 Jul 1990). DOE Contract FG03-86ER53225 ;AC05-78ET53043.

Detailed measurements of heat and particle transport are made on the TEXT tokamak by analyzing the dynamics of the postcrash sawtooth perturbation. Both the density and temperature perturbations are observed to be transported out through the confinement zone at the same rate and exhibit similar scaling with plasma parameters. The density and temperature sawteeth are in phase and highly correlated. These results suggest a strong coupling of plasma particle diffusion and heat flow.

46184 Measurements of vacuum arc ion charge-state distributions. Brown, I.G. (Lawrence Berkeley Lab., CA (USA)); Galvin, J.E. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 17(5): 679-682 (Oct 1989). DOE Contract AC03-76SF00098.

The authors have measured the charge-state distribution of ions generated in the metal vapor vacuum arc under a wide range of experimental conditions. The experiments were carried out using an ion source in which the metal vapor vacuum arc is used as the method of plasma production and by which a high quality, high current beam of metal ions is produced. Charge-state spectra were measured using a time-of-flight diagnostic; arc voltages were also measured. Parameters that were varied include cathode material, arc current, axial magnetic field strength, neutral gas pressure, and arc geometry.

46185 Design principles for a sheet-beam electron gun for a quasi-optical gyrotron. Manheimer, W.M. (Naval Research Lab., Washington, DC (USA). Plasma Physics Div.); Fliflet, A.W.; Lee, R. *IEEE Transactions on Electron Devices (Institute of Electrical and Electronics Engineers) (USA),* 37(3): 840-849 (Mar 1990).

This paper examines the design considerations for a magnetized sheet beam for which the electrons have energy both perpendicular and parallel to the magnetic field. The application envisioned for the sheet beam is the driving of a quasi-optical gyrotron for electron cyclotron resonance heating and current drive in fusion plasmas.

46186 Wave propagation in a switched-on time-varying plasma medium. Gotite, V.R. (Dept. of Electrical Engineering, Univ. Lowell, Lowell, MA (US)); Kalluri, D.K. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 17(5): 828-833 (Oct 1989).

This paper discusses the interaction of an electromagnetic wave with a switched-on time-varying plasma medium. The characteristic features of wave propagation in such a medium are the conservation of wave number and the generation of new waves having frequencies different from that of the incident wave. Initially, a plane wave is assumed to be propagating in free space, and at time $t = 0$ the entire space is converted to a plasma having a time-varying number density. The solution to this problem is obtained through a WKB approximation. The condition of validity of the solution is discussed. Identification of the reflected and transmitted waves constitutes the chief advantage of the method. The ratio of the amplitudes of the electric fields of the reflected and the transmitted waves is shown to depend upon the initial rate of rise of the particle density. This result is useful in diagnosing the initial rate of rise of the number density. To illustrate the method, an exponentially varying number density is considered. Numerical results of the solution of the time-varying differential equations are found to be in good agreement with the proposed solution.

46187 Experimental investigation of a probe-induced localized electron temperature elevation near electron-cyclotron resonance. Mett, R.R. (Wisconsin Univ., Madison, WI (USA). Dept. of Electrical and Computer Engineering); Lam, S.W.; Scharer, J.E. *IEEE Transactions on Plasma Science (Institute of Electrical and Electronics Engineers) (USA),* 17(5): 818-827 (Oct 1989). Contract ECS-8514978.

A spatially localized electron temperature elevation is observed near the electron-cyclotron resonance region. This paper examines detailed properties of this phenomenon. The dependence of the temperature elevation upon launched wave amplitude and frequency relative to the local electron-cyclotron frequency, plasma density, neutral pressure, microwave cavity plasma source tuning, and probe type is discussed. These results are combined with detailed wave electric and magnetic field, emissive probe, and spectral measurements and the use of different Langmuir probe types and orientations to characterize the temperature elevation, background plasma, and wave properties. It is found that the magnetic field and wave absorption near the electron-cyclotron resonance, probe type, and probe tip input impedance as seen from the plasma have important influences on the temperature elevation process. Two-probe correlation measurements are used to show that the elevation process exists in the radial neighborhood (< 1 cm) of the probe tip and along a flux tube parallel to the magnetic field.

46188 Tokamak $\beta aB/I$ limit and its dependence on the safety factor. Ramos, J.J. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (USA)). *Physical Review, A (General Physics) (USA),* 42(2): 1021-1024 (15 Jul 1990). DOE Contract AC02-78ET51013.

It is shown that, for a given tokamak cross-sectional shape and arbitrary values of the magnetic axis safety factor q_0, the first stability condition against pressure-driven magnetohydrodynamic modes has the form $40\pi\beta aB_0/I \leq C_R(q_0)/q_0$. Moreover, in the limit of large q_0, $C_R(q_0)$ becomes independent of q_0 and independent of the toroidal mode number.

46189 Sulfurlike spectra of copper through molybdenum. Kaufman, V. (Atomic and Plasma Radiation Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20899 (USA)); Sugar, J.; Rowan, W.L. *Journal of the Optical Society of America, Part B: Optical Physics (USA),* 7(7): 1169-1175 (Jul 1990). DOE Contract AC05-78ET53043.

The sulfurlike spectra of copper through molybdenum have been identified from observations in tokamak- and laser-generated plasmas. Wavelengths of electric-dipole transitions of the $3s^23p^4$–$(3s3p^5+3s^23p^33d)$ array in the range 75 to 305 A are given. The wavelength uncertainty is estimated to be ±0.007 A. These data have been combined with previously reported wavelengths of magnetic-dipole transitions to determine energy levels for the isoelectronic sequence Cu xiv through Mo xxvii including Rb and Sr for which no observations were made. Ground configuration intervals obtained from magnetic-dipole transitions are compared with Dirac–Fock calculations to predict unknown values and to correct misidentifications. Wavelengths previously classified as chlorinelike $3s^23p^5\ ^2P_{1/2}°$–$3s^23p^4(^3P)3d\ ^2P_{1/2}$ in Cu through Zr are now classified as sulfurlike lines. A new set of observed and interpolated wavelengths for that transition is presented for Cu through Kr.

46190 Spectra and energy levels of sodiumlike ions from Y^{28+} to Sn^{39+}. Reader, J. (National Institute of Standards and Technology, Gaithersburg, Maryland 20899 (USA)); Ekberg, J.O.; Feldman, U.; Brown, C.M.; Seely, J.F. *Journal of the Optical Society of America, Part B: Optical Physics (USA),* 7(7): 1176-1181 (Jul 1990). DOE Contract AC08-80DP40124.

Spectra of ten sodiumlike ions from Y^{28+} to Sn^{39+} were observed with laser-produced plasmas and grazing- incidence spectrographs. Wavelengths, energy levels, and ionization energies were determined for all ions of the isoelectronic sequence from Y to Sn. Revised ab initio and fitted values are given for the 3d–4f wavelengths of the sodiumlike ions K^{8+} and Rh^{34+}. Spectra of sodiumlike ions are generally prominent in high-temperature plasmas. They are important for the diagnosis of plasmas found in tokamaks and laser-fusion targets. They are also important for testing the accuracy of ab initio calculations of atomic structures. In this paper we report wavelengths, energy levels, and ionization energies for ions of the sodium isoelectronic sequence from Y^{28+} to Sn^{39+}.

46191 Local stability of fluid plasmas in the presence of flows. Chun, S.T. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012 (USA)); Hameiri, E. *Physics of Fluids B (USA),* 2(8): 1745-1750 (Aug 1990). DOE Contract FG02-86ER53223.

The Mercier and ballooning instabilities are considered for plasmas with toroidal and poloidal flows in an axisymmetric torus. The stability criteria are derived and compared for the two instabilities. It is found that ballooning modes impose more severe requirements for plasma stability than the Mercier condition.

46192 Saturation of drift instabilities by E×B advection of resonant electrons. Dimits, A.M. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742 (USA)). *Physics of Fluids B (USA),* 2(8): 1768-1774 (Aug 1990). DOE Contract AC02-76CH03073 ;FG05-86ER53221.

Saturation of the collisionless and weakly collisional drift instabilities by nonlinear **E×B** advection of resonant electrons is considered. The nonlinear **E×B** advection of the resonant electrons around the O points and X points of the potential shuts off the linear phase shift between the electron density and the potential, and hence the linear growth, and produces residual oscillations at the **E×B**-trapping frequency. Two analytical solutions of a three-mode model of Lee *et al.* [Phys. Fluids **27**, 2652 (1984)], which describes the saturation of drift waves by this mechanism, are found. The first is an exact solution in the form of a steadily propagating wave of constant amplitude, and is relevant when electron pitch-angle scattering is present. The second is an approximate time-dependent analytical solution, obtained using the method of O'Neil [Phys. Fluids **8**, 2255 (1965)], and is relevant to the collisionless case. The predictions that follow from this solution for the saturation level and for the amplitude oscillation frequency are in excellent agreement with the direct numerical solutions of the three-mode system.

46193 Weak turbulence theory of ion temperature gradient modes for inverted density plasmas. Hahm, T.S. (Princeton Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543 (USA)); Tang, W.M. *Physics of Fluids B (USA),* 2(8): 1815-1821 (Aug 1990). DOE Contract AC02-76CH03073.

Typical profiles measured in H-mode ("high confinement") discharges from tokamaks such as JET [*Proceedings of the 15th European Conference on Controlled Fusion and Plasma Heating* (European Physical Society, Geneva, 1988), Vol. 12B, Part 1, p. 2239] and DIII-D [Phys. Fluids **31**, 3738 (1988)] suggest that the ion temperature gradient instability threshold parameter η_i ($\equiv d \ln T_i/d \ln n_i$) could be negative in many cases. Previous linear theoretical calculations [Phys. Fluids B **1**, 1185 (1989)] have established the onset conditions for these negative η_i modes and the fact that their growth rate is much smaller than their real frequency over a wide range of negative η_i values. This has motivated the present nonlinear weak turbulence analysis to assess the relevance of such instabilities for confinement in H-mode plasmas. The nonlinear eigenmode equation indicates that the three-wave coupling to shorter wavelength modes is the dominant nonlinear saturation mechanism. It is found that both the saturation level for these fluctuations and the magnitude of the associated ion thermal diffusivity are considerably smaller than the strong turbulence mixing-length-type estimates for the more conventional positive η_i instabilities.

46194 Fluctuation spectrum and transport from ion temperature gradient driven modes in sheared magnetic fields. Hamaguchi, S. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712 (USA)); Horton, W. *Physics of Fluids B (USA),* 2(8): 1833-1851 (Aug 1990). DOE Contract FG05-80ET53088.

The ion temperature gradient driven mode or η_i-mode turbulence is reinvestigated based on two-component compressible fluid equations with the polarization drift velocity and adiabatic electrons. The scaling of the anomalous ion heat conductivity with magnetic shear $s=L_n/L_s$ and the excess of η_i over the critical value $\eta_{i,c}$ for marginal stability is found to vary as $\chi_i=g(\rho_s/L_n)(cT_i/eB)(\eta_i-\eta_{i,c})\exp(-\alpha s)$, where $g\gtrsim 1$ and $\alpha\gtrsim 5$.

46195 Parallel electric resistivity in the TFTR tokamak. Zarnstorff, M.C. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543 (USA)); McGuire, K.; Bell, M.G.; Grek, B.; Johnson, D.; McCune, D.; Park, H.; Ramsey, A.; Taylor, G. *Physics of Fluids B (USA),* 2(8): 1852-1857 (Aug 1990). DOE Contract AC02-76CH03073.

The average parallel resistivity and the location of the $q=1$ surface are found to be consistent with the predictions of neoclassical transport theory and inconsistent with classical resistivity (uncorrected for toroidal effects) for Ohmic plasmas in the TFTR tokamak [*Plasma Physics and Controlled Nuclear Fusion Research* 1986 (IAEA, Vienna, 1987), Vol. I, p. 51], both in near-equilibrium and during ramping of the plasma current. These observations are incompatible with theories predicting anomalous parallel resistivity in concert with anomalous perpendicular transport.

46196 The impedance and energy efficiency of a coaxial magnetized plasma source used for spheromak formation and sustainment. Barnes, C.W. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)); Jarboe, T.R.; Marklin, G.J.; Knox, S.O.; Henins, I. *Physics of Fluids B (USA),* 2(8): 1871-1888 (Aug 1990). DOE Contract AC02-76CH03073.

Electrostatic (dc) helicity injection has previously been shown to successfully sustain the magnetic fields of spheromaks and tokamaks. The magnitude of the injected magnetic helicity balances (within experimental error) the flux lost by resistive decay of the toroidal equilibrium. Hence the problem of optimizing this current drive scheme involves maximizing the injected helicity (the voltage-connecting-flux product) while minimizing the current (which multiplied by the voltage represents the energy input and also possible damage to the electrodes). The impedance (voltage-to-current ratio) and energy efficiency of a dc helicity injection experiment are studied on the CTX spheromak [Phys. Fluids **2B**, 3415 (1986)]. Over several years changes were made in the physical geometry of the coaxial magnetized plasma source as well as changes in the external electrical circuit. The source could be operated over a

wide range of external charging voltage (and hence current), applied axial flux, and source gas flow rate.

46197 Suppression of magnetic islands by energetic ions in toroidal plasmas. Hegna, C.C. (Department of Applied Physics, Columbia University, New York, New York 10027 (USA)); Bhattacharjee, A. *Physics of Fluids B (USA)*, 2(8): 1804-1814 (Aug 1990). DOE Contract FG02-86ER53222.

This is a study of the effect of an energetic ion population injected from a neutral beam source on the nonlinear stability of magnetic islands. A kinetic theory is used to obtain the island current, which includes previously known modifications resulting from bootstrap currents and resistive interchanges. The island current thus obtained is used in an asymptotic treatment of the perturbed Ampere's law, which yields an evolution equation for the island width. It is shown that the island width saturates at a very small amplitude in tokamaks (with $\Delta' > 0$) when the energetic ion density profile peaks just outside the rational surface. Energetic ions can also be used to modify the island width in three-dimensional equilibria. It is found that in stellarator equilibria with large vacuum islands, energetic ions can be injected to reduce the widths of equilibrium islands.

46198 Backscattered light near the incident laser wavelength from 0.35 μm irradiated long scale length plasmas. Young, P.E. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550 (USA)); Estabrook, K.G.; Kruer, W.L.; Williams, E.A.; Wegner, P.J.; Drake, R.P.; Baldis, H.A.; Johnston, T.W. *Physics of Fluids B (USA)*, 2(8): 1907-1917 (Aug 1990). DOE Contract W-7405-ENG-48.

Backscattered light at wavelengths near the incident laser wavelength of 0.35 μm irradiated thin targets has been spectrally and temporally resolved. Low-*Z* targets show significant backscattered signals even after the foils burn through when the density gradient scale length is approximately 1000 times the laser wavelength. The results show the importance of considering seeding mechanisms in the plasma.

46199 Test of a visible/near-ultraviolet transmitting, coherent fiber-optic bundle for ultrahigh-vacuum applications. Klepper, C.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-8071 (USA)); Simpkins, J.E. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3371-3372 (Jul 1990). DOE Contract AC05-84OR21400.

A visible/near-ultraviolet transmitting, coherent fiber-optic bundle designed for vacuum applications was tested for vacuum compatibility under ultrahigh vacuum conditions at temperatures up to 310 °C. This development was motivated by the need to view the light emitted by neutrals recycling in the throats of large pump limiters, such as the Advanced Limiter Test-II (ALT-II) and the Tore Supra outboard limiter, without access to a direct, unobstructed optical view from an external port at the back end of the limiter. The temperature inside the pump limiter chamber is typically high (~250 to 300 °C), and the outgassing rate of the fiber-optic bundle must remain low at these temperatures. The fiber bundle that was tested was built as a prototype for a bundle to be eventually used in a pump limiter and is now installed in the pumping duct of the ALT-II pump limiter on TEXTOR. The bundle was designed to be coherent to allow the possibility of imaging a region of the limiter throat onto a spatially resolving instrument.

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Refer also to citation(s) 44064, 44632, 44634, 45232, 45901, 45903, 45905, 45909, 46138, 46167, 46172

46200 (AERE-R-13708) **A study of the environmental impact of fusion.** Sowerby, M.G.; Forrest, R.A. (eds.). UKAEA Harwell Lab. (UK). EURATOM/UKAEA Association. Mar 1990. 172p. Contract CEC 384/89-6/FU UK NET. Source: Available from HM Stationery Office, London, UK, price Pound 22.00.

This report documents a programme of work, to compare the environmental impacts of fusion and some alternative power sources. The study is based on two versions of a reference reactor, described as the standard and the low activation versions, whose impacts are compared with a pressurised water reactor (PWR) and coal-fired power stations. The report describes the production and documentation of the radioactive inventories, the gaseous and aqueous releases during operation and the waste volumes of the systems and considers if there are problems in the packaging of fusion waste. The impacts of the systems are compared by using parameters (e.g. ingestion and inhalation hazards) calculated from the radioactive inventories, studying the result of putting the lifetime wastes of the fusion systems and a PWR in an underground repository and comparing the volumes of waste. The results of the study and the data it is based upon are given in detail in tables and figures and the conclusions of the work are presented. (author).

46201 (BNL–44901) **A search for cold fusion signatures in cathodically charged palladium.** Ritley, K.; Wiesmann, H.; Dull, P.; Lynn, K.; Weber, M. Brookhaven National Lab., Upton, NY (USA). [1990]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-900705–5: 8. world hydrogen energy conference, Honolulu, HI (USA), 22-27 Jul 1990). Order Number DE90016288. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The results of a series of two experiments to observe cold fusion in electrolytically deuterated Pd are reported. The experiments were sensitive to excess heat, sudden temperature fluctuations, neutron and tritium production. No evidence was found to substantiate recent claims regarding this phenomena. 7 refs., 7 figs., 2 tabs.

46202 (CLM-R–298) **Parameters of a reference tokamak reactor.** Cooke, P.I.H. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking); Hancox, R.; Spears, W.R. UKAEA Culham Lab., Abingdon (UK). Dec 1989. 44p. Contract 357/89-1/FU UK NET;375/89-5/FU UK NET. Source: Available from HM Stationery Office, London, price Pound 10.00.

several sets of parameters have been developed for tokamak reactors that might be available around the year 2050 as a result of the Commission's fusion research programme. One parameter set, based on modest improvements in physics and technology relative to present experience, has been adopted as a Reference Reactor for use in further studies including the environmental impact of fusion power. The Reference Reactor parameters have been compared with those of the Base Case reactor developed in a study in the USA in 1987. The computer codes used in the two studies have both been used to generate parameter sets for these two reactors, and differences in resulting parameters and costs are discussed. (author).

46203 (CONF-900814–7) **Accurate calculations of neutron kerma [Kinetic Energy Released in MAterials] and damage from ENDF/B-VI evaluations for silicon, chromium, iron and nickel, and comparison with ENDF/B-V results.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Hetrick, D.M.; Fu, C.Y.; Epperson, S.J.; MacFarlane, R.E. Oak Ridge National Lab., TN (USA). [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 7. ASTM-EURATOM symposium on reactor dosimetry; Strasbourg (France); 27-31 Aug 1990. Order Number DE90016020. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Accurate calculations of kerma (Kinetic Energy Released in MAterials) factors and displacement cross sections are fundamental to studies of neutron heating and neutron radiation damage. Damage and heating studies are important elements in both fission and fusion reactor design. For fusion reactor studies, heating in the blanket helps determine the efficiency, and heating studies in the superconducting magnet regions determine properties of the blanket and shield, thereby affecting the economics of the reactor. Radiation damage is important for reactor core lifetime studies and is related directly to the economy and safety of both fusion and fission reactors. Calculation of kerma factors and displacement cross sections require nuclear data for neutron-induced reactions. These data are normally obtained from evaluated nuclear data libraries, such as ENDF/B (US), JENDL (Japan), JEF/EFF (Europe) and BROND (USSR). Unfortunately, most of these evaluated libraries do not contain sufficient information for a direct calculation of these quantities, and various approximations must be employed. The accuracy of the kerma factors and displacement cross sections, and thus the heating and damage functions, are directly related to the

available information from the data libraries. In this paper we describe improvements incorporated in the latest version of the US library, ENDF/B-VI, which allow exact calculations of these quantities for many of the structural materials included in the library. 11 refs., 6 figs.

46204 (CONF-8908134–31) **High average power CW FELs [Free Electron Laser] for application to plasma heating: Designs and experiments.** Booske, J.H. (Maryland Univ., College Park, MD (USA). Lab. for Plasma Research); Granatstein, V.L.; Radack, D.J.; Antonsen, T.M. Jr.; Bidwell, S.; Carmel, Y.; Destler, W.W.; Latham, P.E.; Levush, B.; Mayergoyz, I.D.; Zhang, Z.X.; Freund, H.P. Maryland Univ., College Park, MD (USA). Lab. for Plasma Research. [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER52147. From 11. international free electron laser conference; Naples, FL (USA); 28 Aug - 1 sep 1989. Order Number DE90011085. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A short period wiggler (period ~ 1 cm), sheet beam FEL has been proposed as a low-cost source of high average power (1 MW) millimeter-wave radiation for plasma heating and space-based radar applications. Recent calculation and experiments have confirmed the feasibility of this concept in such critical areas as rf wall heating, intercepted beam ("body") current, and high voltage (0.5 - 1 MV) sheet beam generation and propagation. Results of preliminary low-gain sheet beam FEL oscillator experiments using a field emission diode and pulse line accelerator have verified that lasing occurs at the predicted FEL frequency. Measured start oscillation currents also appear consistent with theoretical estimates. Finally, we consider the possibilities of using a short-period, superconducting planar wiggler for improved beam confinement, as well as access to the high gain, strong pump Compton regime with its potential for highly efficient FEL operation.

46205 (DOE/DP/40200–130) **University of Rochester unclassified comments and recommendations on the proposed NOVA Upgrade.** McCrory, R.L. Jr.; Soures, J.M.; Verdon, C.P. Rochester Univ., NY (USA). Lab. for Laser Energetics. Jul 1990. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract FC03-85DP40200. Order Number DE90015784. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses benefits of the nova upgrade to the national program and recommended schedule; laser design and target-physics issues.

46206 (DOE/ER/40387–4) **Study of structure of nuclei with neutrons and nuclear data measurements for MFE: Progress report, December 1, 1987–July 31, 1990.** Lane, R.O.; Grimes, S.M. Ohio Univ., Athens, OH (USA). [1990]. 206p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40387. Order Number DE90015733. Source: NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Measurements and analysis of cross sections for neutron-induced reactions of interest to the fusion energy program have been carried out. These include neutron elastic and inelastic cross sections for ^{2}H, ^{10}B and ^{13}C as well as cross sections for ^{54}Fe and ^{56}Fe (n,z) reactions. Most of these data have been analyzed using either R-matrix studies or Hauser-Feshbach calculations. Details of these measurements and analyses are given. Level density measurements and low energy optical model studies for protons have been completed to improve our understanding of (n,z) reactions. Total cross section measurements have also been analyzed to obtain optical model information. Improvements to the facilities at this laboratory are also described. Modifications to the shell model code have enabled further progress to be made in studies of nuclear structure and reaction mechanisms. A description of the code and summary of the structure and level density calculations now in progress are given.

46207 (DOE/ER/52127–67) **Overview of advanced fuel fusion.** Miley, G.H. Illinois Univ., Urbana, IL (USA). Fusion Studies Lab. [1989]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. (CONF-8909101–1: Workshop on tritium and advanced fuels in fusion reactors, Varenna (Italy), 6-15 Sep 1989). Order Number DE90015660. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The status and issues related to the development of advanced fuel fusion are discussed. D-^{3}He is a key advanced fuel since it has the potential of igniting in a variety of confinement concepts. However, to obtain a plentiful source of ^{3}He, either lunar mining or breeding becomes necessary. Highly non-Maxwellian plasmas, such as might occur in beam-beam fusion concepts, are necessary to address fuels like p-^{11}B which have the added advantages of a more aneutronic character and plentiful fuel supply. Such plasmas appear very difficult to achieve but several possible approaches such as electrostatic confinement are noted. 52 refs., 13 figs, 5 tabs.

46208 (DOE/ER/52127–70) **Control of helium accumulation.** Varadarajan, V.; Miley, G.H. Illinois Univ., Chicago, IL (USA). [1990]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. (CONF-900170–2: ITER workshop, Princeton, NJ (USA), 10 Jan 1990). Order Number DE90015658. Source: NTIS, PC A03/MF A01; OSTI; INIS.

The fishbone like oscillations in ignited tokamaks are addressed in an exploratory manner. The effects of the strong m = 1 oscillations and the weak high-frequency oscillations are examined in order to explore the feasibility of utilizing these oscillations for alpha accumulation control. The prospects of achieving small scale continuous alpha removal from the plasma center by mild fishbone-like oscillations are examined.

46209 (DOE/ER/53243–3) **"Compact toroid research": Technical progress report, August 1988–August 1989.** Vlases, G.C. Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program. 25 Aug 1989. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER53243. (UWAERP–21). Order Number DE90016123. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

During the period from August 1988 to August 1989, the CSS project has made progress in three areas: The Coaxial Slow Source Upgrade CSSU version of the device was operated until January of 1989. In the Fall of 1988 Langmuir probes were installed to measure the end losses, the Thomson scattering system was made more sensitive, and a more detailed scan with internal magnetic probes was performed. Since then, the CSSU-centered work has concentrated on refining the analysis and interpretation of data. The CSS device was rebuilt as CSSP in the period Jan–June 1989, and began operation on July 3, 1989. Simultaneously, a new data acquisition and processing system based on a Vax 3200 workstation and MDS and IDL software was developed. The COAX 2 code was significant improved by the treatment of hydrogen ionization, including the radiative loss terms, and the inclusion of a more consistent transport and impurity radiation package. The improved code was used both to interpret the results of the CSSU experiments, and to predict performance for the CSSP and CSS2 devices. Details of these three areas of progress are given in the following sections.

46210 (EGG-PRP–9058) **Irradiation and testing of compact ignition tokamak toroidal field coil insulation materials.** Kanemoto, G.K.; Sherick, M.J.; Sparks, D.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1990. 145p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. Order Number DE90015422. Source: NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report documents the results of an irradiation and testing program performed on behalf of Martin Marietta Energy Systems, Inc. in support of the Compact Ignition Tokamak Research and Development program. The purpose of the irradiation and testing program was to determine the effects of neutron and gamma irradiation on the mechanical and electrical properties of candidate toroidal field coil insulation materials. Insulation samples were irradiated in the Advanced Test Reactor (ATR) in a large I-hole. The insulation samples were irradiated within a lead shield to reduce exposure to gamma radiation to better approximate the desired ration of neutron to gamma exposure. Two different exposure levels were specified for the insulation samples. To accomplish this, the samples were encapsulated in two separate aluminum capsules; the capsules positioned at the ATR core mid-plane and at the top of the fueled region to take advantage of the axial cosine distribution of the neutron and gamma flux; and by varying the length of

irradiation time of the two capsules. Disassembly of the irradiated capsules and testing of the insulation samples were performed at the Test Reactor Area (TRA) Hot Cell Facilities. Testing of the samples included shear compression static, shear compression fatigue, flexure static, and electrical resistance measurements.

46211 (ENEA-RT-FUS–88-31) **Tokamak configuration analysis using the toroidal multipoles method.** Alladio, F.; Crisanti, F.; Marinucci, M.; Micozzi, P.; Tanga, A. ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. 35p. (RT/FUS–88-31). Order Number DE90514475. Source: NTIS (US Sales Only), PC A03/MF A01.

Submitted to Nuclear Fusion.

A precise prediction of the plasma contour is important in the design of new tokamaks, as well as in the definition of the operational scenarios of existing machines, where not only plasma boundary features such as elongation, triangularity, etc., are important, but also the detailed contour of the boundary in the region of the X-point or plasma limiter interaction. In order to fulfill the above requisites, a code has been developed, using the toroidal multipolar moment method, which solves the plasma equilibrium problem for both fixed and free boundaries. The resulting vacuum flux function is then fitted with a set of poloidal coil current valves. This gives the best poloidal coil current distribution (with respect to the magnetic energy, for instance) needed for a given plasma equilibrium. The effect of materials with different values of magnetic permeability has not yet been includes. Examples are given for the X-point and limiter configuration in some machines, e.g., JET, FTU, IGNITOR and ET.

46212 (ENEA-RT-FUS–89-11, pp. 5-8) **Parallel implementation of a laser fusion fluid code on an IBM 3090-400 vector multiprocessor.** Atzeni, S. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)). ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. (CONF-8909354–Exc.: 13. conference on the numerical simulation of plasmas, Santa Fe, NM (USA), 17 Sep 1989). In *Contributions to the 13th conference on the numerical simulation of plasmas (Santa Fe', 17-20 Sep 1989).* Order Number DE90706132. Source: NTIS (US Sales Only), PC A03/MF A01.

DUED is a 2-D, Lagrangian fluid code for the simulation of laser-matter interaction and inertial confinement fusion (ICF) implosions. It is essentially based on a two-temperature hydrodynamics model, with flux-limited conductivities and a proper real-matter equation of state. DUED also takes into account the nuclear fusion reactions, the equations for the concentrations of deuterium and tritium, and a diffusive equation for the transport of the charged fusion products (alpha particles). Laser-plasma interaction is dealt with by a ray-tracing method; NRAY (=20-200) rays are traced at each time level. This paper shows how extensions to the VS (vector) Fortran language have made it possible to obtain interesting parallel performances of the DUED code with relatively modest programming and algorithmic work. (Note that, to the best of this author's knowledge, this is the first parallel implementation of a relatively large fusion code).

46213 (ENEA-RT-FUS–89-11, pp. 9-11) **Automatic rezoning of 2-D Lagrangian meshes with application to laser fusion codes.** Atzeni, S. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)). ENEA, Frascati (Italy). Centro Ricerche Energia. Nov 1989. (CONF-8909354–Exc.: 13. conference on the numerical simulation of plasmas, Santa Fe, NM (USA), 17 Sep 1989). In *Contributions to the 13th conference on the numerical simulation of plasmas (Santa Fe', 17-20 Sep 1989).* Order Number DE90706132. Source: NTIS (US Sales Only), PC A03/MF A01.

Lagrangian fluid codes are widely used for the simulation of a large class of transient processes, including inertial confinement fusion (ICF) experiments and, in particular, laser driven implosions. Mesh rezoning procedures, to account for Lagrangian mesh distortion in two or three dimensional problems, should be automatic (i.e. not requiring intervention of the user to switch them on, or to define the new mesh during code execution), and should preserve the most favourable features of the Lagrangian approach, namely the capability of adapting to the fluid mass distribution, and of discriminating material interfaces. Furthermore, the mapping scheme should guarantee global conservation of the conserved physical quantities, and should keep numerical diffusion and local mapping errors at a tolerable level. This paper proposes new rezoning procedure, suitable for quadrilateral-zone Lagrangian codes for ICF implosions, that was implemented in the 2-D, two temperature code DUED. In order to limit numerical diffusion, a method, based on discrete, occasional rezoning, was devised. The mesh generator and mapping scheme are described.

46214 (ENEA-RT-FUS–89-24) **Sensitivity of ICF reactor targets to long-wavelength drive nonuniformities.** Atzeni, S. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1990. 13p. (RT/FUS–89-24). Order Number DE90514480. Source: NTIS (US Sales Only), PC A03/MF A01.

Submitted to Europhysics Letters.

The sensitivity of a family of high gain inertial confinement fusion (ICF) targets to implosion nonuniformities is studied by means of 2-D numerical simulations. The effect of single wavelength, low mode number perturbations of the driving pressure is considered. It is shown that the ratio, Q, of the 2-D target yield to the yield obtained in the spherically symmetric case is a function of the perturbation parameters, as well as of the spark convergence ratio and of the 1-D ignition margin of the target. The scaling of Q with mode number and amplitude is derived; it is also shown that tolerable levels of nonuniformities depend critically on the 1-D ignition margin.

46215 (ETDE-IT–90-05) **Magnetic particles induced by plasma disruptions in tokamaks.** Franconi, E. ENEA, Frascati (Italy). Centro Ricerche Energia. Dec 1989. 17p. (CONF-891204–39: 4. international conference on fusion reactor materials, Kyoto (Japan), 4-8 Dec 1989). Order Number DE90514459. Source: NTIS (US Sales Only), PC A03/MF A01.

Paper presented at 4th international conference on fusion reactor materials (ICCFRM-4) (Kyoto, 4-8 Dec 1989).

One of the advantages of austenitic stainless steels (e.g. AISI 316) is that they are non-magnetic, and so do not interact with the strong magnetic fields present in the tokamak. Despite this, some limiter elements, subject to several hard disruptions in the FT tokamak, show a ferro-magnetic phase in the melted and recrystallized zone. The stainless steel droplets coming from the limiter also show a strong ferro-magnetic behaviour. In the investigation of the causes that have produced this magnetic phase in the material, it was found that melted droplets coming from the limiter melt layers strike the inner wall with velocities ranging between 1m/s and 50 m/s. This suggests the existence of forces of a different nature acting on the melt layer stability and on droplet dynamics. The presence of magnetic particles on the inner wall of the tokamak vessel seems to be related to their interaction with the toroidal magnetic field gradient present inside the torus. The effects of erosion-redeposition phenomena occurring on the tokamak walls can be strongly increased by the existence of driving forces due to this magnetic particles - del B toroidal field interaction.

46216 (GAO/RCED–90-115FS) **Nuclear science: DOE's acceptance of Academy of Sciences' 1986 inertial fusion technical priorities.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. Mar 1990. 5p. Source: US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA).

This report discusses DOE's inertial confinement program using lasers or particle beam accelerators to bombard tiny fusion fuel capsules to cause a momentary fusion reaction. Six participants are involved in the program. The National Academy of Sciences reviewed the program in 1986 and has another review underway. This fact sheet addresses the following questions: What program priorities did the Academy's 1986 review panel recommend for the program? Which program priorities recommended by the Academy in its 1986 review were accepted by DOE? Which tasks in DOE's contract with KMS were designed by DOE to satisfy the program priorities recommended by the Academy and accepted by DOE?

46217 (JAERI-M–90-056) **Helium gas evacuation experiment by cryopump of JT-60 NBI with condensed SF_6 layers.** Kikuchi, Katsumi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Akino, Noboru; Iida, Kazuhiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1990. 23p. (In Japanese). Order Number DE90513799. Source: NTIS (US Sales Only), PC A03/MF A01.

In the long pulse helium beam injection into Tokamak by JT-60 NBI, a pumping system which can evacuate a large amount of the helium gas was required. A cryo-sorption pump by using SF_6 condensed layers which we developed originally was adopted as a helium gas pumping. The present cryopump in JT-60 NBI which evacuates the hydrogen gas was modified to the cryo-sorption pump. The cryo-sorption pump enabled the long pulse helium beam operation in JT-60 NBI. The total pumping speed by one unit NBI system reached 800 m^3/s for helium gas. The cryo-sorption pump was operated well during helium beam injection and any problem was not found. (author).

46218 (KEK–89-14, pp. 29-52) **High energy electron beam production by V_pxB acceleration.** Nishida, Y. (Utsunomiya Univ. (Japan). Faculty of Engineering). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Oct 1989. (CONF-8908213–: Workshop on role of plasmas in accelerators, Tsukuba (Japan), 21 Aug 1989). In *Proceedings of the workshop on role of plasmas in accelerators*. Order Number DE90759999. Source: NTIS (US Sales Only), PC A06/MF A01.

Accelerators can be divided into three major categories depending on the acceleration principle: (1) potential acceleration, (2) cross field acceleration (CFA) or V_pxB_0 acceleration, and (3) synchronized acceleration. The plasma based particle accelerator has the possibility of producing a much higher gradient in an acceleration field compared with conventional accelerators, if a high power laser and plasma are properly combined. The present report focuses particularly on the cross field acceleration, which has recently drawn greater attention because of higher acceleration efficiency. Microwave-plasma interaction experiments are carried out and results on cross field acceleration phenomena are presented and discussed. A theoretical overview is given first, focusing on different acceleration mechanisms. Major theoretical features of the potential acceleration, cross field acceleration and synchronized acceleration are described. Then, the physics of particle acceleration by V_pxB_0 or the cross field acceleration principle is explained. Finally, recent experimental results on plasma based acceleration are outlined, and major phenomena concerned are discussed. (N.K.).

46219 (LA-UR–89-2875) **Recent advances in excimer laser technology at Los Alamos.** Bigio, I.J.; Czuchlewski, S.J.; McCown, A.W.; Taylor, A.J. Los Alamos National Lab., NM (USA). [1990]. 8p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-900953–1: 8. biennial international symposium on gas flow and chemical lasers, Madrid (Spain), 10-14 Sep 1990). Order Number DE90016441. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Current research in excimer laser technology at Los Alamos progresses in two major areas: in the Bright Source program, the development of ultra-high brightness (sub-picosecond) laser systems, based on discharge-pumped excimer laser amplifiers, continues. Recently we have completed rigorous measurements of the saturation parameter for ultra-short pulses. In the laser fusion program, implementation of the large KrF laser fusion amplifiers have been accompanied by numerous studies of the laser physics and kinetics of large e-beam pumped devices.

46220 (LA-UR–90-2322) **The Bushing Test Facility: A new megavolt-class, meter-scale vacuum insulation test facility.** Butner, J.M.; Smith, J.D.; Honig, E.M.; Ingwersen, P.M.; Umphres, J.D.; Anderson, R.G. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-9009192–7: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015026. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Construction of the Bushing Test Facility (BTF) was completed at the Los Alamos National Laboratory (LANL) in the fall of 1989. The BTF is a new megavolt-class, meter-scale vacuum insulation test facility built to meet two primary objectives: (1) to qualify high-voltage vacuum feedthrough bushings before their installation in the electron-beam diodes of the Aurora KrF laser amplifiers and (2) to investigate fundamental issues related to surface flashover and electrical breakdown in vacuum, thereby enabling us to improve the performance and reliability of high-voltage components for future laser systems. The BTF voltage source is a low-energy (<4.4-kJ), 1-MV Marx generator whose output pulse width is variable from 100 ns to a few microseconds. The large BTF test chamber (2.1 m in diameter and 1.5 m long) allows full-sized Aurora bushings or other large-scale vacuum insulators to be tested at background pressures down to about 10^{-7} torr. This paper will further describe the facility, its experimental checkout and first bushing tests, and the plans for future vacuum insulation research. 11 refs., 5 figs.

46221 (LBL–28167) **Multiple beam induction linac research at LBL.** Garvey, T.; Eylon, S.; Fessenden, T.J.; Hahn, K.; Henestroza, E.; Keefe, D. Lawrence Berkeley Lab., CA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9007111–14: 8. international conference on high-power particle beams, Novosibirsk (USSR), 2-5 Jul 1990; HIFAN–440). Order Number DE90015724. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We present results of progress on the LBL multiple beam induction linac experiment (MBE-4). This machine models the accelerator physics of the electric-focused portion of a driver for heavy ion inertial confinement fusion. Four beams of cesium ions are accelerated in common through twenty four induction gaps while being separately focused in individual electrostatic AG focusing channels. Early experiments have demonstrated current amplification in the linac, from 10 mA to 90 mA per beam. This is achieved both by acceleration (from 200 keV to 1 MeV) and by carefully controlled bunch compression. Recent experiments have concentrated on studies of beams extracted from an ion source which produces 5 mA cesium beams at emittances near 0.03 π mm-mrad (normalized). Experiments and theory show a growth of emittance (by about a factor of 2) as these beams are accelerated through the linac. Results of recent measurements of the transverse emittance behavior of these strongly space-charge-dominated ion beams are reviewed and compared with theory. 9 refs., 3 figs.

46222 (ORNL/FTR–2817) **[Pre-equilibrium nuclear reactions and methods for the calculation of fast neutron nuclear data]: Foreign trip report, February 7, 1988–February 20, 1988.** Fu, C.Y. Oak Ridge National Lab., TN (USA). 4 Mar 1988. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015621. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler was invited to the NEANDC meeting to present a paper on a model for the calculation of double differential cross sections, developed as part of an ORNL project on nuclear data for fusion. the traveler was also invited to the IAEA-CRP meeting to represent the USA for an intercomparison of the nuclear data evaluations for Cr, Fe, Ni, and Pb, all of which were provided or promised for the nuclear data library of the International Thermonuclear Engineering Reactor project by the four participating groups (USA, Japan, USSR, and Europe). At ECN, the traveler obtained detailed information on codes developed there for processing the ENDF/B-VI File-6 data and compared in detail the European and USA evaluations of nuclear data for Ni and Pb.

46223 (ORNL/FTR–3701) **[Plasma facing components and blanket/first wall engineering]: Foreign trip report, July 2, 1990–July 28, 1990.** Davis, J.W. (McDonnell Douglas Missile Systems Co., St. Louis, MO (USA)). Oak Ridge National Lab., TN (USA). 13 Aug 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015803. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report summarizes the observations developed during participation in two workshops which were held at the ITER site in Garching, FRG, during the summer session. Participating in these workshops were approximately 25 scientists representing the European Community, Japan, USSR, and the United States.

46224 (ORNL/TM–11542) **Modeling of hydrocarbon fueling.** Hogan, J.T. (Oak Ridge National Lab., TN (USA)); Pospieszczyk, A. Oak Ridge National Lab., TN (USA). Jul 1990. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-901099–1: 7. American Physical Society topical conference on atomic processes in plasmas, Gaithersburg, MD (USA), 2 Oct 1990). Order Number DE90014790. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have compared a database of rate coefficients for CH_4 with experiments on PISCES-A to understand the role of carbon-based impurities in determining the fueling profile of carbon-dominated machines. A three-dimensional Monte Carlo model that embodies the Ehrhardt-Langer CH_4 breakup scheme has been developed. The model has been compared with spectroscopic observations of the spatial variation of the hydrocarbon product decay rates, and reasonable agreement has been found. The comparison is sensitive to the non-Maxwellian electron distribution and to observed spatial inhomogeneities in the electron density and temperature profiles. Applications of the model to parameters characteristic of the tokamak scrape-off layer are presented.

46225 (ORNL/TM–11546) **ORNL [Oak Ridge National Laboratory] Controlled Fusion Atomic Data Center: Thirty years later.** Hunter, H.T.; Phaneuf, R.A.; Kirkpatrick, M.I. Oak Ridge National Lab., TN (USA). Aug 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90014817. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The ORNL Controlled Fusion Atomic Data Center (CFADC) handles requests for information and data on fusion processes, maintains a comprehensive bibliographical database, and publishes recommended atomic collision data in what have been popularly called "Redbooks," to support the fusion community's current atomic and molecular data needs. A recent improvement in the efficiency and operation of the data center has been the addition of a customized database management system implemented on a personal computer system in 1988, and a desktop publishing station in 1989. This paper will describe the present scheme for handling numerical and bibliographic data and emphasize how they facilitate the mission of the CFADC. 1 ref.

46226 (PB–90-874108/XAB) **Fusion reactor theory and conceptual design. January 1982-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1982-May 1990.** National Technical Information Service, Springfield, VA (USA). Jun 1990. 160p. Source: NTISPC N01/MF N01.

Supersedes PB–84-874700.

This bibliography contains citations concerning theoretical and conceptual aspects of fusion reactor physics and designs. Conceptual design studies for a wide variety of fusion reactors are covered. Some experimental and demonstrational results of studies are considered. (This updated bibliography contains 290 citations, 189 of which are new entries to the previous edition.)

46227 (PNL-SA–16932) **Overview of copper irradiation programs.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (USA)); Hamilton, M.L.; Anderson, K.R.; Stubbins, J.F.; Singh, B.N.; Horsewell, A.; Sommer, W.F. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830 ;W-7405-ENG-36. Order Number DE90015546. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The objective of this effort is to provide data on the radiation response of copper alloys intended for both near-term and long-term applications in fusion systems. 12 refs., 5 tabs.

46228 (PNL-SA–17022) **Electrical resistivity changes induced in copper alloys by fast neutron irradiation.** Anderson, K.R. (Illinois Univ., Urbana, IL (USA)); Stubbins, J.F.; Garner, F.A.; Hamilton, M.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE90015554. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Thirteen copper-base alloys were irradiated in FFTF/MOTA to determine the response of various alloy classes to neutron irradiation. This effort is directed toward the selection of copper alloys to serve as high heat flux components in both near-term and long-term fusion devices. Post irradiation measurements showed that a wide variety of responses was observed in the neutron-induced changes in electrical resistivity. 8 refs., 14 figs., 3 tabs.

46229 (PNL-SA–17145) **Tensile behavior and swelling of ternary austenitic alloys irradiated in different neutron spectra.** Hamilton, M.L. (Pacific Northwest Lab., Richland, WA (USA)); Garner, F.A.; Okada, A. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90015295. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Two nominally identical experiments designed to study the effects of nickel level, chromium level and helium generation rate on the microstructural development and tensile properties of Fe–Cr–Ni alloys are currently undergoing examination. One of these, conducted in ORR at higher He/dpa rate and a lower displacement rate compared to the other experiment in EBR-II, shows substantially more strengthening and a different temperature range of swelling. The effect of irradiation temperature, neutron flux and neutron spectra appear to be larger than those of the compositional variations studied. Transmission electron microscopy (TEM) examination is in progress to determine the origin of the observed changes. 11 refs., 8 figs., 5 tabs.

46230 (PNL-SA–17529) **Relationship between microstructure, spinodal-like decomposition and selective electropolishing of irradiated invar-type alloys.** McCarthy, J.M.; Garner, F.A. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90015293. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

EDX analysis and selective electropolishing were used to study two specimens of Fe-35Ni irradiated with neutrons at 420° and 520°C and one specimen of Fe-35Ni-15Cr irradiated at 510°C. Each was shown to be spinodally decomposed with the period of compositional oscillation appearing to decrease with decreasing irradiation temperature. When polishing conditions are used which promote etching, the low nickel micro-volumes are selectively attacked. The level of chromium appears to play no role in either the selective attack or the period of oscillation. The scale of surface irregularity and that of compositional oscillation appear to be identical but not related to the presence of currently existing microstructural components. 9 refs., 6 figs.

46231 (PNL-SA–17548) **Unusual tensile and fracture behavior of pure copper at high levels of neutron-induced swelling.** Anderson, K.R. (Illinois Univ., Urbana, IL (USA)); Stubbins, J.F.; Garner, F.A. Pacific Northwest Lab., Richland, WA (USA). Apr 1990. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900623–13: 15. symposium on effects of radiation on materials, Nashville, TN (USA), 17-21 Jun 1990). Order Number DE90016358. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The most common measures of ductility are uniform and total elongation and reduction of area. Pure copper in the unirradiated state exhibits large amounts of both measures of ductility along with a serpentine glide fracture morphology. After irradiation at 411–414°C with fast neutrons to 34 or 50 displacements per atom (dpa), the tensile and fracture behavior change greatly. Significant uniform elongation is retained but the reduction of area is very small. Such a unilateral shift between macroscopic measures of ductility is unusual. The fracture surface is also unusual and reflects not only the influence of the large swelling levels attained during irradiation but also the distribution of swelling near grain boundaries. The unique fracture mode in highly voided copper appears to enhance susceptibility to crack propagation and sudden failure without necking, even though the material exhibits a significant level of uniform elongation prior to failure. 12 refs., 8 figs.

46232 (PNL-SA–17636) **Density changes of generation 1.5 and 2.0 copper alloys irradiated at 411–414° C and 529° C in FFTF-MOTA.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (USA)); Brager, H.R.; Anderson, K.R. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90015291. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The intrinsic swelling rate of pure copper and Cu-5Ni appears to be ~ 5%/dpa at ~ 400°C. At 529°C the swelling rate of these alloys appears to be much lower. In more complex precipitation-strengthened alloys phase instabilities appear to play a role in determining the onset of void swelling and also the density of the

unvoided matrix. Dispersion-hardened alloys were found to be very resistant to swelling. Large amounts of oxygen in an alloy, however, can overcome the swelling resistance imparted by very high densities of oxide dispersoids. Internally oxidized Glidcop alloys offer the most pronounced resistance to swelling, with the transient regime progressively extended as alumina content increases. Unfortunately, laser welding destroys the swelling resistance of dispersion-strengthened alloys. 10 refs., 8 figs.

46233 (PNL-SA-17683) **Impact behavior of irradiated V-15Cr-5Ti following hydrogen removal.** Hamilton, M.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830 ;W-31109-ENG-38. Order Number DE90015289. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To be submitted for publication as part of the Fusion Reactor Materials semiannual progress report, March 31, 1989.

The purpose of this work was to determine whether the impact behavior of irradiated V-15Cr-5Ti could be improved by removing the hydrogen which is suspected to be contributing to the radiation-induced degradation previously observed in the ductile to brittle transition temperature (DBTT).

46234 (PNL-SA-17804) **The effect of helium on microstructural evolution in austenitic steels as determined by spectral tailoring experiments.** Sekimura, N. (Tokyo Univ. (Japan)); Garner, F.A.; Griffin, R.D. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 14p. Sponsored by U.S. DOE Energy Research; Japan/U.S. FFTF-MOTA Collaboration of U.S. DOE and Monbusho. DOE Contract AC06-76RL01830. (CONF-900623--15: 15. symposium on effects of radiation on materials, Nashville, TN (USA), 17-21 Jun 1990). Order Number DE90016360. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Fe-15Cr-XNi alloys irradiated at both low (0.66 to 1.2) and very high (27 to 58) helium/dpa levels exhibit significantly different levels of strengthening due to an unprecedented refinement of cavity microstructure at the very high helium levels. When compounded with the nickel dependence of helium generation, the cavity distribution for some irradiation conditions and alloy compositions can be driven below the critical radius for bubble to void conversion, leading to a delay in swelling. 9 refs., 6 figs., 1 tab.

46235 (PNL-SA-17896) **Isotopic tailoring and other techniques used to study helium effects in austenitic alloys.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (USA)); Hamilton, M.L.; Stubbins, J.F.; Sekimura, N.; Kawanishi, H. Pacific Northwest Lab., Richland, WA (USA). [1990]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9005247--3: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). Order Number DE90016344. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A review is presented of the early results of several related studies designed to explore in simple Fe-Cr-Ni alloys the influence of helium/dpa ratio in competition with other important material and environmental variables at 330–600°C. While helium at fusion-relevant levels influences the details of the microstructure somewhat, the resultant changes in macroscopic properties such as swelling and tensile behavior are relatively small. However, when greater-than-fusion levels of helium are generated, an extensive refinement of microstructure occurs, leading to depression of swelling at lower temperatures and increased strengthening at all temperatures studied. 23 refs., 10 figs.

46236 (PNL-SA-17897) **Overview of copper irradiation programs.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (USA)); Hamilton, M.L.; Brager, H.R.; Anderson, K.R.; Stubbins, J.F.; Singh, B.N. Pacific Northwest Lab., Richland, WA (USA). May 1990. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9005247--2: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). Order Number DE90016343. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A review is presented of an ongoing series of irradiation experiments on copper alloys being conducted in the FFTF reactor. These experiments are designed to explore the potential use of copper and copper alloys for high heat flux applications in fusion power devices. A summary of early significant results is also presented.

46237 (PNL-SA-18229) **Radiation-induced microstructural development and microchemical changes in Fe-Cr-Mn-Ni solute-bearing alloys.** Takahashi, H. (Hokkaido Univ., Sapporo (Japan)); Ohnuki, S.; Garner, F. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-900623--12: 15. symposium on effects of radiation on materials, Nashville, TN (USA), 17-21 Jun 1990). Order Number DE90016359. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The density changes measured in three Fe–Cr–Mn–Ni solute-bearing austenitic alloys irradiated in FFTF-MOTA indicate that nickel additions do not decrease swelling as had been anticipated, but actually increase swelling initially. These data were confirmed by microscopy examination but are contrary to the behavior observed during electron irradiation of these same alloys. Nickel and commercially relevant solute additions also appear to suppress the formation of ferrite and sigma phases, which were observed in solute-free Fe–Cr–Mn ternary alloys irradiated in the same experiment. 8 refs., 11 figs.

46238 (PNL-SA-18388) **Microstructure-tensile property correlation of 316SS in low dose neutron irradiations.** Yoshida, N. (Kyushu Univ., Fukuoka (Japan)); Muroga, T.; Araki, K.; Heinisch, H.L.; Kiritani, M. Pacific Northwest Lab., Richland, WA (USA). May 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-891204--38: 4. international conference on fusion reactor materials, Kyoto (Japan), 4-8 Dec 1989). Order Number DE90014803. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The objective of this work is to determine the effects of the neutron spectrum on radiation-induced changes in mechanical properties for metals irradiated with fission and fusion neutrons. 10 refs., 6 figs.

46239 (RISO-M-2857) **A fast-acting hydrogen gas source for staged pneumatic high-speed acceleration of fusion plasma fuel pellets.** Andersen, S.A.; Baekmark, L. Risoe National Lab., Roskilde (Denmark). Physics Dept. Feb 1990. 36p. Order Number DE90636060. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This report describes a possible design of a fast, high-temperature, arc-driven hydrogen gas source module, to be used in a scheme for multistage high-speed pneumatic acceleration of fusion plasma fuel pellets. The potential of this scheme for operating with a moderate driving pressure at long acceleration path lengths is particular attractive for accelerating fragile hydrogen isotope ice pellets. From experiments with an ethanol-based arc unit, design parameters for a propeller module were assessed, and with a barrel-mounted ethanol module staged pneumatic acceleration of a plastic dummy pellet was demonstrated. In experiments with a hydrogenbased, cryogenic arc unit in which 200 joules of electrical energy were dissipated with a power level approaching 5 MW within 30 mus, the velocity of a 23-mg plastic pellet was increased from 1.7 to 2.4 km/s. Results in terms of barrel pressure transients and arc characteristics are described. (author) 20 ills., 8 refs.

46240 (SAND-90-0910C) **Electrohydrodynamic lithium ion-source experiments on PBFA [Particle Beam Fusion Accelerator] 2.** Adams, R.G. (Sandia National Labs., Albuquerque, NM (USA)); Woodworth, J.R.; Pregenzer, A.L.; Lockner, T.R.; Gerber, R.A.; Johnson, D.J.; Jaramillo, W.H.; Dillon, M.M.; Coats, R.S.; Halliburton, M.; Primm, P.; Torres, G.; Ziska, G.; Atwood, T. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009192--8: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015207. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We are developing anodes to test the electrohydrodynamic (EHD) instability as a means of producing an intense lithium beam on Sandia's Particle Beam Fusion Accelerator II. In a strong electric field (~10 MV/cm) a molten lithium or lithium nitrate surface is predicted to become EHD unstable and deform into a dense array

of cusps with sub-micron spacing. Ions field-evaporated from the cusp tips from the ion beam. We have dealt with a number of problems in fielding these liquid sources in PFBA II. The vertical liquid anode surface required has been formed by suspending the molten anode material in a porous metal frit. In order to attain the high electric fields required to turn on the EHD source, 5-Tesla B-fields must be impressed in the A-K gap of the Applied-B ion Diode. Unless the amount of flux passing through the anode surface is carefully minimized, eddy currents induced in the anode cause the ejection of molten lithium from the anode surface. Applying the 5-Tesla B-fields on the diode has required peak currents in the diode B-field coils of 70–100kA. Rapid corrosion of molten lithium occurs even in the 5×10^{-5} Torr diode vacuum. Recent developments include a new diode design which has allowed us to reach a uniform 5-Tesla B-field on the anode surface, fast heating of the anode, which melts the lithium and allows it to wick up into the anode frit just before the accelerator shot, and development of reflectance-based monitors of molten anode surface quality. Results of recent accelerator shots will be discussed. 2 refs., 12 figs.

46241 (SAND–90-1002C) **A Refractive INdex Gradient (RING) diagnostic for transient discharges or expansions of vapor or plasmas.** Cuneo, M.E. (Sandia National Labs., Albuquerque, NM (USA)); Lockner, T.R.; Tisone, G.S.; Bieg, K.W.; Stinnett, R.W.; Chavez, J.R. Sandia National Labs., Albuquerque, NM (USA). [1990]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009192–12: International symposium on discharges and electrical insulation in vacuum, Santa Fe, NM (USA), 17-20 Sep 1990). Order Number DE90015840. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The use of lasers to measure plasma properties is well known. Common methods include interferometry (density), Schlieren (gradient of density), and shadowgraphy (derivative of gradient). The diagnostic described in this paper uses a fast silicon photodiode quadrant detector with a differential amplifier to temporally detect the refraction of a CW laser by transient discharges or expansions of vapor, gas or plasma. The laser beam is refracted by the gradient of the total index of refraction due to neutral and ionized atoms (positive index) and electrons (negative index) in those discharges. The output of the circuit is a voltage proportional to the deflection angle of the laser beam through the discharge. The method is a time-resolved, quantitative, species discriminating (i.e. atoms or electrons) Schlieren technique. The diagnostic is easy to field, sensitive (1.3 ± 0.1 to 3.3 ± 0.1 mv/μrad depending on laser power, divergence, moment arm and circuit gain) and fast (rise time = 11 ± 1 to 24 ± 1 ns depending on various circuit parameters). Diagnostic theory, and circuit design and performance will be discussed. This refractive INdex Gradient (RING) diagnostic has been applied to measurements on several ion sources under development at Sandia for use on intense applied-B ion diodes in the light ion fusion program. Sources studied include different types of flashboards, a thermal evaporation lithium ion source, and a laser produced ion source. To illustrate the utility of this technique, examples of measurements on LEVIS (Laser EVaporation Ion Source), a laser produced active lithium ion source will be given. Measured properties include vapor/plasma production thresholds, expansion velocities, some species information, gradient profiles, and estimates of density profiles. 27 refs., 8 figs.

46242 (UCRL–101768) **Damage assessment and possible damage mechanisms to 1-meter diameter Nova turning mirrors.** Edwards, G.; Campbell, J.; Wolfe, R.; Lindsey, E. Lawrence Livermore National Lab., CA (USA). Aug 1990. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8911192–6: 1989 Boulder damage symposium, Boulder, CO (USA), 1-3 Nov 1989). Order Number DE90016473. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A major concern in the operation of the LLNL 120 kJ Nova laser system is damage to the nominal I-meter diameter mirrors (i.e. HR coatings). The damage appears to originate from microscopic defects that vary in size up to approximately 30 μm in diameter. These defects produce damage sites up to 250 μm and, in some cases, covering 20% or more of the mirror surface. Defects due to particulates that are in or under the coating are highly unlikely due to the fact that coating thickness is only 5 μm thick and particles up to 30 μm would produce surface roughness that could be easily detected. Consequently, the defects must be plate-like (i.e. "2-D") in nature. A by-product of the damage is a haze left on the surface of the mirror. This haze is analyzed and shown to be blown-off particles of ZrO_2/SiO_2 coating material. The particle morphology suggests nucleation from a vapor phase which implies localized heating in the coating to temperatures on the order of 3000°K. Some possible damage mechanisms are also explored. 10 refs. 8 figs., 2 tabs.

46243 (UCRL–101945-Rev.1) **A distributed control and monitor system used in laser fusion research: Revision 1.** Jones, B.A.; Selchow, N.J. Lawrence Livermore National Lab., CA (USA). Mar 1990. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901017–1-Rev.1: International conference and exhibition of the Instrument Society of America, New Orleans, LA (USA), 14-19 Oct 1990). Order Number DE90011483. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Laser Fusion research experiments require very low pressure environments to properly diagnose the plasma physics phenomena occurring during laser fusion reactions. Target chambers with very large and complex pumping systems are required to achieve and maintain these extremely low pressures. This paper describes a recently installed distributed control and monitoring system that automates the operation of these pumping systems. Through automation, this system is providing an enhanced shot rate by reducing the manpower required to ready the system for a target shot while increasing the overall safety of the system. 5 figs.

46244 (UCRL–101945-Rev.2) **A distributed control and monitor system used in laser fusion research: Revision 2.** Jones, B.A.; Selchow, N.J. Lawrence Livermore National Lab., CA (USA). May 1990. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-901017–1-Rev.2: International conference and exhibition of the Instrument Society of America, New Orleans, LA (USA), 14-19 Oct 1990). Order Number DE90013478. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Laser Fusion research experiments require very low pressure environments to properly diagnose the plasma physics phenomena occurring during laser fusion reactions. Target chambers with very large and complex pumping systems are required to achieve and maintain these extremely low pressures. This paper describes a recently installed distributed control and monitoring system that automates the operation of these pumping systems. Through automation, this system is providing an enhanced shot rate by reducing the manpower required to ready the system for a target shot while increasing the overall safety of the system. 6 figs.

46245 (UCRL-CR–104380) **Final report for the tunable driver for the LLNL FEL experiment.** Guss, W.C.; Basten, M.A.; Kreischer, K.E.; Temkin, R.J. Lawrence Livermore National Lab., CA (USA). Jun 1990. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE90015602. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This section of the report covers the recent operation of the prototype backward-wave oscillator (BWO) gyrotron. The tube was mounted in its fixture on the superconducting magnet, the beam aligned, and microwaves generated. Initial alignment and operation was performed at low wiggler magnet strength (B_w = 9 G) and thus low $\alpha = v_\perp/v_\parallel$. The microwaves observed under these conditions were at a frequency just above the electron cyclotron frequency of the interaction region. Identification of these waves is tentatively that of forward waves generated in what is a very long gyrotron cavity. By increasing the wiggler field to $\approx$ 18 G, the backward wave could then be observed. Voltage tunability of the backward wave was demonstrated and frequencies from 13 GHz to 143 GHz were observed.

46246 (UCRL-ID–104441) **Beryllium pressure vessels for creep tests in magnetic fusion energy.** Neef, W.S. Lawrence Livermore National Lab., CA (USA). 20 Jul 1990. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE90014862. Source: NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Beryllium has interesting applications in magnetic fusion experimental machines and future power-producing fusion reactors. Chief among the properties of beryllium that make these applications possible is its ability to act as a neutron multiplier, thereby increasing the tritium breeding ability of energy conversion blankets. Another property, the behavior of beryllium in a 14-MeV neutron environment, has not been fully investigated, nor has the creep behavior of beryllium been studied in an energetic neutron flux at thermodynamically interesting temperatures. This small beryllium pressure vessel could be charged with gas to test pressures around 3, 000 psi to produce stress in the metal of 15,000 to 20,000 psi. Such stress levels are typical of those that might be reached in fusion blanket applications of beryllium. After contacting R. Powell at HEDL about including some of the pressure vessels in future test programs, we sent one sample pressure vessel with a pressurizing tube attached (Fig. 1) for burst tests so the quality of the diffusion bond joints could be evaluated. The gas used was helium. Unfortunately, budget restrictions did not permit us to proceed in the creep test program. The purpose of this engineering note is to document the lessons learned to date, including photographs of the test pressure vessel that show the tooling necessary to satisfactorily produce the diffusion bonds. This document can serve as a starting point for those engineers who resume this task when funds become available.

46247 (UCRL-JC–104159) **A 3d particle simulation code for heavy ion fusion accelerator studies.** Friedman, A. (Lawrence Livermore National Lab., CA (USA)); Bangerter, R.O.; Callahan, D.A.; Grote, D.P.; Langdon, A.B.; Haber, I. Lawrence Livermore National Lab., CA (USA). 8 Jun 1990. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48 ;AC03-76SF00098. (CONF-900603–30: 2. European particle accelerator conference, Nice (France), 11-16 Jun 1990). Order Number DE90015365. Source: NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We describe WARP, a new particle-in-cell code being developed and optimized for ion beam studies in true geometry. We seek to model transport around bends, axial compression with strong focusing, multiple beamlet interaction, and other inherently 3d processes that affect emittance growth. Constraints imposed by memory and running time are severe. Thus, we employ only two 3d field arrays (ρ and ϕ), and difference ϕ directly on each particle to get E, rather than interpolating E from three meshes; use of a single 3d array is feasible. A new method for PIC simulation of bent beams follows the beam particles in a family of rotated laboratory frames, thus "straightening" the bends. We are also incorporating an envelope calculation, an (r, z) model, and 1d (axial) model within WARP. The BASIS development and run-time system is used, providing a powerful interactive environment in which the user has access to all variables in the code database. 10 refs., 3 figs.

46248 (UCRL-JC–104455) **Long-term flat-field behavior in LLNL streak cameras: Preliminary results.** Hatch, J.A.; Montgomery, D.S.; Prior, J. Lawrence Livermore National Lab., CA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–33: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015615. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The flat-field profile of LLNL streak cameras fitted with either S-1 or S-20 photocathode tubes is monitored and updated periodically. This paper will describe how these streak camera flat-fields change over the course of 12 to 25 months as well as research into the processes which drive this degradation.

46249 (UCRL-JC–104456) **Evaluation of dynamic range for LLNL streak cameras using high contrast pulses and "pulse podiatry" on the Nova laser system.** Richards, J.B.; Weiland, T.L.; Prior, J.A. Lawrence Livermore National Lab., CA (USA). Jul 1990. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–32: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015203. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A standard LLNL streak camera has been used to analyze high contrast pulses on the Nova laser facility. These pulses have a plateau at their leading edge (foot) with an amplitude which is approximately 1% of the maximum pulse height. Relying on other features of the pulses and on signal multiplexing, we were able to determine how accurately the foot amplitude was being represented by the camera. Results indicate that the useful single channel dynamic range of the instrument approaches 100:1. 1 ref., 4 figs., 1 tab.

46250 (UCRL-JC–104457) **Recent advances in gated x-ray imaging at LLNL.** Wiedwald, J.D.; Bell, P.M.; Kilkenny, J.D.; Bonner, R.; Montgomery, D.S. Lawrence Livermore National Lab., CA (USA). Jul 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-900756–31: SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit, San Diego, CA (USA), 8-13 Jul 1990). Order Number DE90015201. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Inertial Confinement Fusion program at LLNL is becoming increasingly dependent on time-resolved, two-dimensional x-ray imaging for measurement of target dynamics. A gated x-ray imaging module has been developed over the last several years and has evolved into a "standard" design. This design makes use of primarily mass-produced components, with customized image area characteristics defined by the geometry of an electrode evaporated onto the front surface of a microchannel plate (MCP). As a result, we now have eight imaging modules operating on Nova and will be adding five more in the next few months. In the past year, in addition to assembling and installing gated imaging modules, we have also measured their performance characteristics and investigated possible enhancements for future (or retro-fitted) modules. We have been looking at the entire process from detection of an x-ray photon to digitization of the photographic film. A companion paper describes efforts to further reduce the aperture time by using thinned MCP's. In this paper, we focus on results associated with the spatial resolution and noise of the imaging module and the image recording process. We first present the performance characteristics of the standard imaging module; then describe potential enhancements to the performance. In the course of this work, we made measurements of the transverse electron energy distribution at the exit of the MCP. Results are reported for both DC and pulsed MCP bias voltage, and the differences are analyzed. We also investigated an alternative phosphor screen and studied the noise and sensitivity of various photographic films.

46251 **A comparison of hydrogen vs. helium glow discharge effects on fusion device first-wall conditioning.** Dylla, H.F. (Princeton Plasma Physics Laboratory, Princeton University, Princeton, NJ 08543 (USA)). *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 3-18 (5 Feb 1990). DOE Contract AC02-76CH03073. (CONF-8904230–: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

Hydrogen- and deuterium-fueled glow discharges are used for the initial conditioning of magnetic fusion device vacuum vessels following evacuation from atmospheric pressure. Hydrogenic glow discharge conditioning (GDC) significantly reduces the near-surface concentration of simple adsorbates such as H_2O, CO, and CH_4, and lowers ion-induced desorption coefficients by typically three orders of magnitude. The time evolution of the residual gas production observed during hydrogen-glow discharge conditioning of the carbon first-wall structure of the TFTR device is similar to the time evolution observed during hydrogen GDC of the initial first-wall configuration in TFTR, which was primarily stainless steel. Recently, helium GDC has been investigated for several wall-conditioning tasks on a number of tokamaks including TFTR. Helium GDC shows negligible impurity removal with stainless steel walls. For impurity conditioning with carbon walls, helium GDC shows significant desorption of H_2O, CO, and CO_2; however, the total desorption yield is limited to the monolayer range. In addition, helium GDC can be used to displace hydrogen isotopes from the near-surface region of carbon first-walls in order to lower hydrogenic retention and recycling.

46252 Helium glow wall conditioning of the DIII-D tokamak with large area graphite coverage. Jackson, G.L. (General Atomics, San Diego, CA 92138 (USA)); Taylor, T.S.; Petersen, P.I.; Taylor, P.L. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 39-49 (5 Feb 1990). DOE Contract AC03-89ER51114. (CONF-8904230--: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

Helium glow wall conditioning (HeGWC) is the primary technique for conditioning the DIII-D walls which are composed of Inconel and graphite. Presently, 40% (31 m^2) of the DIII-D plasma facing surfaces consist of graphite tiles covering the inside, top, and bottom DIII-D walls which are the high heat flux surfaces for divertor and inside wall limiter discharges. HeGWC with $T_{wall} \leq 50$ °C is effective both in removing low Z impurities and desorbing hydrogenic particles from this large graphite 'reservoir. The effective desorption of hydrogen species from the graphite has led to lower recycling and improved particle control during tokamak discharges.

46253 Ion energy measurements in steady state discharges. Schwager, L.A. (Sandia National Laboratoaries, Div. 8347, Livermore, CA 94551-0969 (USA)); Hsu, W.L.; Tung, D.M. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 72-79 (5 Feb 1990). (CONF-8904230--: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

The energy distribution of ions incident on the grounded surface (cathode) of a direct current (DC) glow discharge is measured. This incident energy determines the effectiveness of glow discharge cleaning in removing gases and impurities from the vessel surface. We have found that the incident ion energy falls significantly below the anode potential when the mean free path for charge exchange is less than the width of the cathode sheath which is approximately the Child-Langmuir sheath width. The DC discharge provides a current density at the grounded surface of typically 17 micro-Amps/cm^2. A gas mix of deuterium and argon at pressures up to 40 mTorr is ignited to form the plasma. A mass and energy analyzer measures the energy distribution of the ion stream which passes through an aperture in the center of the electrically grounded surface.

46254 Study of hydrogen release from carbon films by helium and deuterium glow discharges. Hsu, W.L. (Sandia National Laboratories, Livermore, CA 94550-0969 (USA)). *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 80-92 (5 Feb 1990). (CONF-8904230--: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

Protium-rich carbon films were deposited by an RF-assisted DC glow- discharge in methane gas. The desorption characteristics of the trapped protium by ion bombardment in a subsequent glow-discharge were studied using partial pressure analysis of the desorbed species. Desorption by both helium and deuterium glow-discharges was investigated. In a helium glow, protium was released primarily as H_2 and in a deuterium glow, as H_2 and HD. The desorption rate over time cannot be described by a single e-folding rate. A desorption cross-section was estimated by fitting an exponential to the data measured near the beginning of the desorption run sequence. At a bias voltage of 350 V, both D and He ions show a near identical desorption cross-section of $\sim 7.5 \times 10^{-17}$ cm^2. Deuterium glows were found to desorb ~4 times more protium than those from helium glows at comparable operating conditions.

46255 Recent results on cleaning and conditioning the ATF vacuum system. Langley, R.A. (Oak Ridge National Laboratory, Oak Ridge, TN 37831-8072 (USA)); Clark, T.L.; Glowienka, J.C.; Goulding, R.H.; Mioduszewski, P.K.; Rasmussen, D.A.; Rayburn, T.F.; Schaich, C.R.; Shepard, T.D.; Simpkins, J.E.; Yarber, J.L. *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 19-29 (5 Feb 1990). DOE Contract AC05-84OR21400. (CONF-8904230--: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

Techniques for cleaning and conditioning the vacuum vessel of the Advanced Toroidal Facility (ATF) and its internal components are described. The vacuum vessel cleaning technique combines baking to 150 °C and glow discharges with hydrogen gas. Chromium gettering is used to further condition the system. The major internal components are the anodized aluminum baffles in the Thomson scattering system, a graphite-shielded ICRF antenna, two graphite limiters, and a diagnostic graphite plate. Three independent heating systems are used to bake some of the major components of the system. The major characteristics used for assessing cleanliness and conditioning progress are the maximum pressure attained during bakeout, the results of gas analysis, and revelant plasma parameters (e.g., time to radiative decay). Details of the various cleaning and conditioning procedures and results are presented.

46256 End points in discharge cleaning on TFTR. Mueller, D. (Princeton Plasma Physics Laboratory, Princeton University, Princeton, N. J. 08543, USA (USA)); Dylla, H.F.; Bell, M.G.; Blanchard, W.R.; Bush, C.E.; Gettelfinger, G.; Hawryluk, R.J.; Hill, K.W.; Janos, A.C.; Jobes, F.C.; LaMarche, P.H.; Owens, *AIP Conference Proceedings (American Institute of Physics) (USA),* 199(1): 30-38 (5 Feb 1990). DOE Contract AC02-76CH03073. (CONF-8904230--: AVS topical conference on surface conditioning of vacuum systems, Los Angeles, CA (USA), 3-5 Apr 1989).

It has been found necessary to perform a series of first-wall conditioning steps prior to successful high power plasma operation in the Tokamak Fusion Test Reactor (TFTR). This series begins with glow discharge cleaning (GDC) and is followed by pulse discharge cleaning (PDC). During machine conditioning, the production of impurities is monitored by a Residual Gas Analyzer (RGA). PDC is made in two distinct modes: (1) Taylor discharge cleaning (TDC), where the plasma current is kept low (15–50 kA) and of short duration (50 ms) by means of a relatively high prefill pressure, and (2) aggressive PDC, where lower prefill pressure and higher toroidal field result in higher current (200–400 kA) limited by disruptions at $q(a) \approx 3$ at ≈250 ms. At a constant repetition rate of 12 discharges/minute, the production rate of H_2O, CO, or other impurities has been found to be an unreliable measure of progress in cleaning. However, the ability to produce aggressive PDC with substantial limiter heating, but without the production of X-rays from runaway electrons, is an indication that TDC is no longer necessary after $\approx 10^5$ pulses. During aggressive PDC, the uncooled limiters are heated by the plasma from the bakeout temperature of 150 °C to about 250 °C over a period of three to eight hours. This limiter heating is important to enhance the rate at which H_2O is removed from the graphite limiter.

46257 Two-dimensional fiber ablation in the solid-deuterium *Z* pinch. Lindemuth, I.R. (Applied Theoretical Physics Division, Los Alamos National Laboratory, Los Alamos, NM (USA). Inertial Fusion and Plasma Theory Group). *Physical Review Letters (USA),* 65(2): 179-182 (9 Jul 1990). DOE Contract W-7405-ENG-36.

Initial two-dimensional magnetohydrodynamic computer calculations of the formation and evolution of the solid-deuterium-fiber Z pinch are reported. The computations show that the m=0 instability occurs very early in the discharge. The m=0 behavior leads to the formation of hot spots off axis and enhances the fiber ablation rate. A rapid onset of neutron production occurs when the fiber has totally ablated. The computations are in qualitative agreement with experimental observations at several laboratories and lead to a new interpretation of the experimental diagnostics.

46258 Subcooled water flow boiling at 1.66 MPa under uniform high heat flux conditions. Boyd, R.D. Sr. (Prairie View A and M Univ., TX (USA)). *Fusion Technology (USA),* 16(3): 324-330 (Nov 1989).

Steady-state subcooled water flow boiling experiments have been carried out in a uniformly heated horizontal circular channel with an exit pressure of 1.66 MPa and with the mass velocity G varying from 4.4 to 32.0 $Mg/m^2 \cdot s$. These experiments are related to high heat flux removal in fusion reactor beam dumps and first walls in compact fusion reactors. For the chosen values of L/D and exit pressure, the measured critical heat flux (CHF) values are higher than any previous values for smooth tubes in the literature. An increase in the exit pressure resulted in an increase in the slope of this relationship. However, the local heat transfer coefficient actually decreased as the pressure increased, for the same power level and mass velocity.

46259 Mixed deuterium-tritium neutral beam injection: An alternative heating method for fusion reactors. Ruby, L. (Reed Coll., Portland, OR (USA)); Lewis, M.S. *Fusion Technology (USA)*, 16(4): 491-497 (Dec 1989).

An alternative mixed beam neutral beam injector (MNBI) for fusion reactors is proposed that eliminates the conventional isotope separation system (ISS) in the fuel cycle. The principal advantage of the alternative system is a capital and operating cost savings in the fuel cycle, as the ISS employs cryogenic distillation at liquid-hydrogen temperatures to effect a separation of hydrogen isotopes and to eliminate a buildup of normal hydrogen in the recycled fuel. Possible additional advantages of the alternative method involve an improvement in overall safety and a reduction of the amount of tritium in the fuel cycle. The alternative heating system uses an electromagnetic separation in the MNBI to limit the buildup of normal hydrogen. Calculations indicate that an MNBI can be reasonably optimized in the case of an upgraded injection system for the Tokamak Fusion Test Reactor.

46260 An alternative approach to major tritium production. Kummash, T. (Michigan Univ., Ann Arbor, MI (USA)); Galbraith, D.L. *Fusion Technology (USA)*, 16(4): 469-473 (Dec 1989).

Two schemes have been proposed to replace the aging tritium production facilities at Savannah River, South Carolina. The U.S. Department of Energy and the federal government have reiterated their plan to build a heavy water reactor and a high-temperature gas-cooled reactor at a cost of about $7 billion as replacements for the Savannah River facility. A group of scientists from national laboratories, on the other hand, have proposed the use of a linear accelerator to accelerate protons to produce neutrons to be used to produce tritium in lithium targets. Yet another scheme is proposed that is safe and potentially less expensive than the other two. It relies on existing or rapidly developing laser technology to drive a magnetically insulated inertial confinement fusion device, which has already produced copious amounts of neutrons that could readily be used in producing tritium.

46261 Implosion symmetry of heavy-ion-driven inertial confinement fusion targets. Kothe, D.B. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (USA)); Brackbill, J.U.; Choi, C.K. *Physics of Fluids B (USA)*, 2(8): 1898-1906 (Aug 1990).

Mechanisms that induce implosion asymmetries in ion-driven inertial confinement fusion (ICF) targets are identified and investigated by studying the two-dimensional hydrodynamic response of the heavy-ion-driven HIBALL target [Boch, in *Heavy Ion Inertial Fusion*, AIP Conf. Proc. No. 152, Washington, DC (American Institute of Physics, New York, 1986), p. 23] in planar geometry. The implosion of the multilayered, single-shell target is subjected to two symmetry-reducing mechanisms: (1) spatial beam intensity nonuniformities and (2) target material interface perturbations. In self-consistent numerical calculations, the target implosion symmetry is found to be sensitive to spatial variations in beam energy deposition resulting from interface perturbations in the path of the beam and coherent intensity variations in the beam itself. The asymmetries in beam energy absorption perturb the flow in the target absorption layer. If the resulting fluid perturbations are seeded at the hydrodynamically unstable pusher–fuel interface, they can grow with rates comparable to the Rayleigh–Taylor instability when lateral wavelengths are comparable to the payload shell thickness. Coherent variations in beam intensity as small as 5%–10% at low intensity (1 TW/cm^2) and 1% at high intensity (1000 TW/cm^2) limit the usable target implosion energy.

46262 Near-surface sputtered particle transport for an oblique incidence magnetic field plasma. Brooks, J.N. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439 (USA)). *Physics of Fluids B (USA)*, 2(8): 1858-1863 (Aug 1990).

Near-surface sputtered particle transport has been analyzed numerically using models of sputtering, sheath parameters, and impurity collisions with a background D–T plasma. Tungsten and carbon sputtering was examined, for tokamak divertor plasma conditions. Redeposited ion parameters computed include the charge state, transit time, energy, and angle of incidence. A regime of operation for finite self-sputtering of tungsten has been identified. This regime is broader than previous estimates. Results for energetically sputtered and thermally sputtered carbon are compared.

46263 Interaction of impurity ions with a weakly non-Maxwellian simple hydrogenic plasma. Terry, W.K. (Fusion Power Program, Argonne National Laboratory, Argonne, Illinois 60439 (USA)). *Physics of Fluids B (USA)*, 2(8): 1944-1946 (Aug 1990). DOE Contract W-31109-ENG-38.

The average acceleration of an ensemble of "test particles" in a plasma is called the "dynamical friction"; the average rate at which their velocity vectors spread out in velocity space is expressed in a velocity-space diffusion-rate tensor. These quantities have been derived for impurity ions interacting with a weakly non-Maxwellian simple hydrogenic plasma. The derivation is sketched briefly in this Brief Communication; for details, the reader is referred to a supplementary report (see NTIS Document No. DE88017137).

46264 Computer-assisted microballoon selection for inertial confinement fusion targets. Immesoete, C.K. (Laboratory For Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299 (USA)); Scarantino, S.; Kim, H.; Forsley, L. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3324-3326 (Jul 1990). DOE Contract FC03-85DP40200.

Current inertial confinement fusion experiments require large numbers of well-characterized microballoon targets. Microballoons are batch-produced, and balloons of target quality are selected based on several parameters: outside diameter, wall thickness, and wall concentricity. Selection and characterization of these targets is a labor intensive process. We have developed a computer-controlled microballoon selection system that allows us to select microballoons five times faster than our previous methods with less operator fatigue and with less emphasis on operator skill.

46265 Uniform liquid-fuel layer produced in a cryogenic inertial fusion target by a time-dependent thermal gradient. Gram, R.Q. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299 (USA)); Wittman, M.D.; Immesoete, C.; Kim, H.; Craxton, R.S.; Sampat, N.; Swales, S.; Pien, G.; Soures, J.M.; Kong, H. *Journal of Vacuum Science and Technology, A (Vacuum, Surfaces and Films) (USA)*, 8(4): 3319-3323 (Jul 1990). DOE Contract FC03-85DP40200.

Targets for inertial confinement fusion are cooled by cryogenic helium gas jets in an environment of room-temperature thermal radiation in an effort to obtain uniform condensed deuterium–tritium (DT) layers. A time-dependent thermal gradient obtained by ohmic heating of the upper nozzle is found to produce a transient state of uniformity in liquid DT just above its freezing point. A replaceable assembly of nozzles with heaters and thermometers is designed to be implemented in the target chamber of the OMEGA laser. Targets are held between the nozzles by spider webs which are attached to an independently positioned fixture. A flow of He of 6×10^{-5} g/s is sufficient to obtain the uniform DT layer, producing a background pressure in a test chamber of 0.5 mTorr. Targets are characterized interferometrically in two orthogonal views. Interferograms are compared with computed templates to determine the thickness and uniformity of the condensed layer.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 44426

9901 Management

Refer also to citation(s) 44249, 44255, 44321, 44421, 44422

46266 (DOE/MA–0409) **Department of Energy annual procurement and financial assistance report, FY 1989.** USDOE Office of Procurement and Assistance Management, Washington, DC (USA). Apr 1990. 42p. Sponsored by U.S. DOE Management & Administration. Order Number DE90016008. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document provides the 1989 fiscal year report on the procurement and financial assistance activity of the Department of

Energy (DOE). DOE is generally not a consumer of the technology it develops, nor does it procure production quantities of hardware for its own use. DOE is involved in basic and applied research in a wide range of technology areas including the following: nuclear energy, nuclear waste management, fossil energy, conservation, renewable energy, and nuclear weapons development. The DOE procurement activities also support national security in the production and testing of nuclear weapons and the management of the Strategic Petroleum Reserve and the Naval Petroleum and Oil Shale Reserves. With the exception of the national security activities and departmental administration, DOE spends its procurement dollars more as a catalyst for technology development than for acquiring goods and services for federal use. DOE enters into contractual arrangements with large and small firms involved in the technology areas for which it is responsible. In addition, DOE is involved in contractual and financial assistance activities with educational institutions, nonprofit organizations, and State and local governments.

46267 (KURRI-TR–326) **Summary reports of activities under visiting research program in Research Reactor Institute, Kyoto University, first half of 1989.** Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Dec 1989. 63p. (In Japanese). Order Number DE90513928. Source: NTIS (US Sales Only), PC A04/MF A01.

This book contains 56 brief reports of studies carried out at the Research Reactor Institute of Kyoto University. These reports deal with 'Neutron Transmutation Doping on Compound Semiconductor', 'Study on the Influence of the Neutron Irradiation on the Low Temperature Strength of Various Welded Joint of Dissimilar Materials', 'Low Temperature Irradiation Effect on Iron-Alloys and Ceramics', 'Luminescent Phenomena from Some Kinds of Rock and Mineral Slices Accompanied with Gamma-irradiation', 'Study of Irradiation Effects on Simulated Waste Glass Irradiated Using $^{10}B(n,\gamma)^{7}Li$ Reaction', 'Neutron Spectrometry with CR-39 Track Detector', 'Performance Study on Superconducting Magnet Materials in Thermonuclear Fusion Conditions', 'Fast Neutron Radiography with KUR-Linac', 'Study of Photo-Excited Metastable State and Their Relaxation of Irradiation Defects in Silicon and Diamond by Using a SQUID Magnetometer', 'Moessbauer Study on Radiation Damage of Metals and Alloys', 'Radiation Damages in Super Ionic Conductors', 'Basic Study on ^{74}As Production by (γ,n) Reaction', etc. (N.K.).

46268 (RISO-M–2854) **Agricultural research department. Annual report 1989.** Risoe National Lab., Roskilde (Denmark). Agriculture Dept. Jan 1990. 39p. (In Danish). Order Number DE90637400. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

The annual report gives a general review of the research work of the department. The activities of the year are described in short project reports followed by a list of publications, posters and lectures. Further, the report gives three review articles on selected subjects related to the work: "Chitinase in barley and rape seed", "Symbiotic nitrogen fixation" and "Biological control of powdery mildews". Included in the report are also a list of the staff members, guest scientists and students, lectures given at the department, and a list of travel - and other acitivities. (author) 10 refs.

46269 (UCRL-LR–104227) **The Chinese-American Workforce: Career satisfaction of Chinese-American professionals in a scientific laboratory in the San Francisco Bay Area.** Nissen, S.H. Lawrence Livermore National Lab., CA (USA). May 1990. 107p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015596. Source: NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The current study focused on a group of Chinese-American professionals working in a scientific environment in the San Francisco Bay area. One of the goals of the present study is to determine to what extent do the Chinese cultural values impact job performance, interpersonal relationships and perception of job satisfaction. This was carried out by identifying the important motivational factors and optimal working conditions which provided career satisfaction for the Chinese-American professionals. Comparisons were made between the US born and foreign-born respondents to determine differences, if any, in their perceptions relative to career satisfaction due to varying acculturation levels. In addition, this study identified barriers to career advancement and compared these barriers with the results of another survey on the Chinese-American professionals working in government, industry and private sector in the Bay area. A structured survey questionnaire was designed by the investigator and sent to 167 Chinese-American professionals, composed of both US-born and foreign-born. 41 refs., 12 figs., 8 tabs.

46270 (UM-P–89/75) **Resource letter for Accelerated Matter Program.** Rossi, F. Melbourne Univ., Parkville (Australia). School of Physics. Jul 1989. 31p. Order Number DE90637392. Source: NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS.

This resource letter covers diverse literature(400 titles) relevant to the Accelerated Matter Program in the Particles and Fields Group at the University of Melbourne. Specifically, the research areas covered are: inertia induced electric fields in accelerated matter; strain induced contact potentials; the patch effect/surface potentials. There are no claims made for completeness. The areas of gravity, acceleration and strain induced effects in matter, and drift tube experiments with matter/antimatter are extensively covered, if not complete. The literature on acceleration/inertia induced effects in metals has a long history dating back to the 19th century and the reader is referred to the review by Barnett (1935) for an extensive list of references not included here. All other work following this 1935 review, has been included here. The literature on surface physics is very extensive and no attempt has been made to cover it all. Every major paper on metal surfaces has been cited. Several other references have been included which fall only loosely into the above areas and they represent useful and/or interesting material for this research program.

9902 Mathematics and Computers

Refer also to citation(s) 43677, 43678, 43836, 43909, 43956, 43957, 44013, 44014, 44016, 44017, 44018, 44085, 44090, 44094, 44097, 44098, 44126, 44168, 44172, 44173, 44183, 44185, 44194, 44198, 44199, 44215, 44278, 44281, 44310, 44320, 44323, 44324, 44325, 44326, 44339, 44343, 44345, 44349, 44350, 44351, 44353, 44354, 44363, 44365, 44368, 44369, 44379, 44469, 44502, 44506, 44512, 44574, 44584, 44611, 44613, 44713, 44819, 44890, 44958, 44964, 44968, 44969, 44972, 44974, 44978, 44979, 45034, 45054, 45097, 45109, 45114, 45167, 45181, 45184, 45186, 45191, 45194, 45195, 45196, 45199, 45200, 45216, 45220, 45221, 45225, 45246, 45252, 45277, 45465, 45523, 45542, 45708, 45730, 45757, 45773, 45774, 45775, 46044, 46048, 46091, 46107, 46113, 46152, 46166, 46177, 46212, 46213, 46326, 46334

46271 (AD-A–221071/4/XAB) **Relationship between energy density and net power (intensity) in coupled one-dimensional dynamic systems. Final report.** Maidanik, G.; Dickey, J. David Taylor Research Center, Bethesda, MD (USA). Propulsion and Auxiliary Systems Dept. May 1990. 13p. (DTRC/PAS–90/22). Source: NTIS, PC A03/MF A01.

A formalism for the power flow vector of a complex composed of a multitude of one-dimensional dynamic systems has been developed using wave propagation concepts. In this formalism, the complex is defined in terms of two diagonal propagator matrices, two terminal position vectors, and two junction matrices. An element in a propagator matrix describes the manner in which power, in a specific dynamic system, propagates toward a junction. An element in a terminal vector defines the terminal position, in a specific dynamic system, at a junction. A junction is the boundary that defines the coupling among the dynamic systems at a common terminal vector. An element in a junction matrix defines either the coupling (transmission action) between two distinct dynamic systems or the self-coupling (reflection action) at the designated junctior.. The formalism accounts for the energetics of coupled one-dimensional dynamic systems. Neglecting cross terms between linear propagation toward one and the other junction, that the stored energy density vector is the sum of the stored energy density vector associated with propagation of power toward one junction and with that propagating toward the other junction. Under the same conditions, the net power (intensity) vector is the difference between the power vector associated with power propagation toward one junction and with that propagating toward the other.

Since the energy stored and the power flow are simply related by a speed of propagation, the stored energy density vector and the net power (intensity) vector are supplemental quantities.

46272 (AD-A-221291/8/XAB) **Using integrity constraints to control search in knowledge-base systems.** Gaasterland, T.; Giuliano, M.; Litcher, A.; Liu, Y.; Minker, J. Maryland Univ., College Park, MD (USA). Inst. for Advanced Computer Studies. Feb 1990. 46p. (UMIACS-TR-90-27). Source: NTIS, PC A03/MF A01.

A knowledge base system combines data management and reasoning capabilities. It can be used to store and manipulate a body of knowledge which consists of a set of rules and facts. The rules and facts in a knowledge base capture syntactic information. In contrast, integrity constraints contribute semantic information about the represented knowledge. They impose restrictions on the states of the world that a knowledge base can model. Typically, integrity constraints are used to update and maintain the knowledge base, but they can also be a powerful tool for answering queries. A logic programming system augmented with constraint processing, data storage, and data manipulation capabilities forms the basis for a knowledge base system. Both a runtime approach and a compiled approach to using integrity constraints in logic programming systems to identify and eliminate unproductive search activity have been implemented within an existing parallel logic programming system, PRISM. We have thus extended PRISM to be a testbed for knowledge base applications. The extended system provides the basis for a series of experiments which (1) compare the performance of the compiled approach and the runtime approach, (2) demonstrate that significant classes of knowledge representation domains can use integrity constraints effectively, and (3) reveal additional techniques necessary to put the theoretical approaches into practice. We show that using constraints to process a query can reduce search space and response time. Furthermore we show that the compiled approach reduces response time much more than the runtime approach.

46273 (AD-A-221398/1/XAB) **Managing parallelism and resources in scientific data-flow programs. Technical report.** Culler, D.E. Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science. Mar 1990. 245p. (MIT/LCS/TR-446). Source: NTIS, PC A11/MF A02.

Exploiting parallelism to achieve high performance invariably increases the resource requirements of a program. This is particularly serious under dynamic dataflow execution, because all the potential parallelism in a program is exposed. The resource requirements can be excessive, often leading to deadlock. This phenomenon is documented using parallelism and resource profiles derived under an ideal dataflow execution model. This report examines how resource requirements can be managed effectively by controlling the ways in which parallelism is exposed. A mechanism for controlling parallelism in scientific programs, called k-bounded loops, is presented. This involves compiling loops into dataflow graphs in a manner that allows the maximum number of concurrent iterations to be set dynamically, when the loop is invoked. A policy for employing this mechanism is developed and tested on a variety of programs. Through static analysis of the program, parametric resource expressions are formulated and the potential parallelism is characterized. Based on this analysis, the program is augmented with resource management code that computes the k-bounds by simple formulae, involving program variables and an overall resource parameter that reflects the capacity of the machine. This approach is shown to be effective for containing the resource requirements of scientific dataflow programs, while exposing adequate parallelism.

46274 (AD-A-221435/1/XAB) **Architectures for optical computing. Final report, 1 September 1986-31 January 1990.** Levy, S. Rutgers-the State Univ., New Brunswick, NJ (USA). Lab. for Computer Science Research. 31 Jan 1990. 108p. Source: NTIS, PC A06/MF A01.

The activities of the CAM group are recorded herein. These consist of the development of several experimental software systems on an AMT DAP (Distributed Array Processor) for evaluation and research purposes. The resulting determinations of the strengths and weakness of the DAP are discussed. Two new machine architectures were developed in an attempt to consolidate the strengths and overcome the weaknesses. The effort led to the analysis of certain parallel algorithms from a new point of view, and thus to a new class of parallel algorithms, the semi-serial algorithms.

46275 (AD-A-221486/4/XAB) **Programming environment for parallel-vision algorithms. Final technical report, February 1988-December 1989.** Brown, C. Rochester Univ., NY (USA). Dept. of Computer Science. 11 Apr 1990. 78p. Source: NTIS, PC A05/MF A01.

See also report dated July 88, AD-A203 309.

This contract developed and disseminated papers, ideas, algorithms, analysis, software, applications, and implementations for parallel programming environments for computer vision and for vision applications. The work has been widely reported and highly influential. The most significant work centered on the Butterfly Parallel Processor, the MaxVideo pipelined parallel image processor, and the development of the real-time computer vision laboratory. For the Butterfly, the Psyche multi-model operating system was developed and the CONSUL autoparallelizing compiler was designed. Much basic and influential performance monitoring and debugging work was completed, resulting in working systems and novel algorithms. There was also significant research in systems and applications using other parallel architectures in the laboratory, such as the MaxVideo parallel pipelined image processor. The contract developed a heterogeneous parallel architecture involving pipelined and MIMD parallelism and integrated it with a robot head.

46276 (AD-A-221568/9/XAB) **Tutorial on techniques and applications for natural language processing.** Hayes, P.J.; Carbonell, J.G. Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Computer Science. 17 Oct 1983. 45p. (CMU-CS-83-158). Source: NTIS, PC A03/MF A01.

Natural language communication with computers has long been a major goal of Artificial Intelligence both for what it can tell us about intelligence in general and for its practical utility - data bases, software packages, and AI-based expert systems all require flexible interfaces to a growing community of users who are not able or do not wish to communicate with computers in formal, artificial command languages. Whereas many of the fundamental problems of general natural language processing (NLP) by machine remain to be solved, the area has matured in recent years to the point where practical natural language interfaces to software systems can be constructed in many restricted, but nevertheless useful, circumstances. This tutorial is intended to survey the current state of applied natural language processing by presenting computationally effective NLP techniques, by discussing the range of capabilities these techniques provide for NLP systems, an by discussing their current limitations. Following the introduction, this document is divided into two major sections: the first on language recognition strategies at the single sentence level, and the second on language processing issues that arise during interactive dialogues. In both cases, we concentrate on those aspects of the problem appropriate for interactive natural language interfaces, but relate the techniques and systems discussed to more general work on natural language, independent of application domain.

46277 (AD-A-221569/7/XAB) **Parallel hashing and integer sorting. Technical report.** Matias, Y.; Vishkin, U. Maryland Univ., College Park, MD (USA). Inst. for Advanced Computer Studies. Jan 1990. 31p. (UMIACS-TR-90-13). Source: NTIS, PC A03/MF A01.

The problem of sorting n integers from a restricted range (1..m), where m is superpolynomial in n, is considered. An o(n log n) randomized algorithm is given. Our algorithm takes O(n log log m) expected time and O(n) space. (Thus, for m = n sub polylog(m) we have an O(n log log n) algorithm.) The algorithm is parallelizable. The resulting parallel algorithm achieves optimal speed up. Some features of the algorithm make us believe that it is relevant for practical applications. A result of independent interest is a parallel hashing technique. The expected construction time is logarithmic using an optimal number of processors, and Searching for a value takes O(1) time in the worst case. This technique enables drastic reduction of space requirements for the price of using randomness. Applicability of the technique is demonstrated for the parallel sorting algorithm, and for some parallel string matching algorithms. The parallel sorting algorithm is designed for a strong and non standard model of parallel computation. Efficient simulations of the

strong model on a CRCW PRAM (Concurrent Read Concurrent Write Parallel Random Access Machine) are introduced. One of the simulations even achieves optimal speed up. This is probably a first optimal speed up simulation of a certain kind.

46278 (AD-A–221603/4/XAB) **Critical problems in very-large-scale computer systems. Semiannual technical report, 1 October 1989-31 March 1990.** Agarwal, A.; Dally, W.J.; Devadas, S.; Knight, T.F.; Leighton, F.T. Massachusetts Inst. of Tech., Cambridge, MA (USA). 31 Mar 1990. 71p. Source: NTIS, PC A04/MF A01.

The research vehicle for this contract is the largest possible computer that can be conceived for the mid to late 1990's. We call this machine an American Resource Computer or ARC. We imagine this machine to occupy several floors of a building. The nation could probably only afford one or two ARC's. The machine will be used to solve large-scale scientific problems having both military and civilian applications. This investigation addresses the hardware technology, software techniques, algorithms, communications, processing elements, and applications. The study is determining the plausibility (not feasibility) of the machine. The technical challenges of such a machine serve as our guiding stimulus for the research carried out and reported here.

46279 (AD-A–221678/6/XAB) **Debugging and analysis of large-scale parallel programs. Doctoral thesis.** Mellor-Crummey, J.M. Rochester Univ., NY (USA). Dept. of Computer Science. Sep 1989. 149p. (TR–312). Source: NTIS, PC A07/MF A01.

One of the most serious problems in the development cycle of large-scale parallel programs is the lack of tools for debugging and performance analysis. Parallel programs are more difficult to analyze than their sequential counterparts for several reasons. First, race conditions in parallel programs can cause non-deterministic behavior, which reduces the effectiveness of traditional cyclic debugging techniques. Second, invasive, interactive analysis can distort a parallel program's execution beyond recognition. Finally, comprehensive analysis of a parallel program's execution requires collection, management, and presentation of an enormous amount of information. This dissertation addresses the problem of debugging and analysis of large-scale parallel programs executing on shared-memory multiprocessors. It proposes a methodology for top-down analysis of parallel program executions that replaces previous ad-hoc approaches. To support this methodology, a formal model for shared-memory communication among processes in a parallel program is developed. It is shown how synchronization traces based on this abstract model can be used to create indistinguishable executions that form the basis for debugging. This result is used to develop a practical technique for tracing parallel program executions on shared-memory parallel processors so that their executions can be repeated deterministically on demand.

46280 (AD-A–221757/8/XAB) **Disconnected actions: An asynchronous extension to a nested atomic action system. Technical report.** Ben-Zvi, B. Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science. Jan 1990. 112p. (MIT/LCS/TR–475). Source: NTIS, PC A06/MF A01.

The main challenge facing the design of reliable distributed computing systems is maintaining data integrity in the presence of concurrency and failures. Atomic transactions, or actions, are a widely accepted solution to these two problems; they are serializable and recoverable, thus hiding concurrency and failures. Nested transactions are a generalization of the model of atomic transactions. Nested transactions, or subactions, provide a uniform mechanism for coping with failures and obtaining concurrency within an action. Execution of a nested action is synchronized with its creating action by halting the creator until the execution of its nested action terminates. This thesis proposes a new kind of nested action called a Disconnected Action (DA) that runs asynchronously with its creating action. Disconnected actions allow additional work to be done in parallel with the rest of the work in a nested atomic action system. Work done by a DA improves the performance of its creating action, but is not needed for the correctness of this action. This thesis shows how DAs semantics are achieved; existing mechanisms, such as the two-phase commit, are modified, and serial behavior of DA is ensured by a mechanism that uses timestamps to enforce static creation order, and tables to monitor and control dynamic serialization order of concurrent DAs. The thesis also proposes a technique that allows an action using DAs to commit in spite of some failures.

46281 (AD-A–221780/0/XAB) **Linear algebra on a Cray X-MP. Technical document.** Freund, R.F. Naval Ocean Systems Center, San Diego, CA (USA). Apr 1990. 13p. (NOSC/TD–1670). Source: NTIS, PC A03/MF A01.

This paper discusses basic issues of vectorization as well as memory organization and contention for vector machines. There is an analysis of the implications of these issues for the performance of basic linear algebra operations, SAXPY and SDOT.

46282 (AD-A–221871/7/XAB) **Parallel algorithms for computer vision. Final report, 31 August 1988-31 January 1990.** Poggio, T. Massachusetts Inst. of Tech., Cambridge, MA (USA). Artificial Intelligence Lab. Apr 1990. 64p. Source: NTIS, PC A04/MF A01.

See also AD-A183 755, AD-A203 947 and AD-A212 489.

The main effort in this project has been directed towards the development of an integrated vision system, - the Vision Machine - based on a parallel supercomputer. The core of the Vision Machine is in fact a set of parallel algorithms for visual recognition and navigation in an unstructured environment. The present version of the Vision Machine has been demonstrated to process images in close to real time by (1) computing first several low-level cues, such as edges, stereo disparity, optical flow, color and texture, (2) integrating them to extract a cartoon-like description of the scene in terms of the physical discontinuities of surfaces, and (3) using this cartoon in a recognition stage, based on parallel model matching. In addition to the development of the parallel algorithms, their implementation and testing, we have also done substantial work in several areas that are very closely related. These include (1) design and fabrication of VLSI circuits to transfer to potentially cheap and fast hardware some of the software algorithms, (2) initial development of techniques to synthesize by learning vision algorithms, and (3) several projects involving autonomous navigation of small robots.

46283 (BNL–44003) **[Long-term behavior of nonlinear oscillators]: Foreign trip report, April 3–17, 1988.** Stewart, H.B. Brookhaven National Lab., Upton, NY (USA). 2 May 1988. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90015221. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research collaboration with Prof. Ueda on the long-term behavior of nonlinear oscillators, particularly Duffing's equation, was pursued using Ueda's own numerical software. The history of Udea's research on chaos going back to 1061 was discussed. Discussions were held with several other faculty members and students interested in nonlinear dynamics.

46284 (CEA-CONF–10019) **New method for the determination of failure and repair rates of complex systems.** Eid, M.; Duchemin, B. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1989. 11p. (CONF-8906352–: Reliability' 89 Conference, Brighton (UK), 14-16 Jun 1989). Order Number DE90514655. Source: NTIS (US Sales Only), PC A03/MF A01.

A new mathematical model for reliability calculations is proposed. It is baptized Differential Model of Equivalent parameters, DMEP. It deals with coherent systems, described by fault trees. A system has two exclusive states, running and repairing one. A complex system may be composed of complex subsystems. System decomposition may continue till we attain the simplest components (subsystems). A simple component has constant failure and repair rates. A subsystem, simple or not, is represented by a system of first order differential equations.

46285 (CEA-CONF–10020) **Linear and non-linear applications of modal analysis to seismic loadings.** Brochard, D.; Gantenbein, F.; Petit, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1989. 6p. (CONF-890721–: Joint ASME/JSME pressure vessel and piping conference, Honolulu, HI (USA), 23-27 Jul

1989). Order Number DE90514654. Source: NTIS (US Sales Only), PC A02/MF A01.

In this paper, a general method is presented for solving dynamic linear and non-linear problems using modal analysis technique. An application of this method is shown for substructuring technique on a simple geometry. Then, in the particular case of structures with free boundary conditions for the modal basis calculation, a simpler presentation is described and the truncation effect is illustrated. Finally, this method is applied for treating the problem of a sliding mass under a seismic loading. This example shows that modal analysis is also well-adapted for solving non-linear problems.

46286 (CEA-CONF–10021) **Numerical evaluation of cracked pipes under dynamic loading.** Petit, M.; Jamet, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1989. 7p. (CONF-890721–: Joint ASME/JSME pressure vessel and piping conference, Honolulu, HI (USA), 23-27 Jul 1989). Order Number DE90514653. Source: NTIS (US Sales Only), PC A02/MF A01.

In order to apply the leak-before-break concept to piping systems, the behavior of cracked pipes under dynamic, and especially seismic, loadings must be studied. A simple finite element model of a cracked pipe has been developed and implemented in the general purpose computer code CASTEM 2000. The model is a generalization of the approach proposed by Paris and Tada (1). Considered loads are bending moment and axial force (representing thermal expansion and internal pressure.) The elastic characteristics of the model are determined using the Zahoor formulae for the geometry-dependent factors. Owing to the material behabior plasticity must be taken into account. To represent the crack growth, the material is defined by two characteristic values: J_{1c} which is the level of energy corresponding to crack initiation and the tearing modulus, T, which governs the length of propagation of the crack. For dynamic loads, unilateral conditions are imposed to represent crack closure. The model has been used for the design of dynamic tests to be conducted on shaking tables. Test principle is briefly described and numerical results are presented. Finally evaluation of margin, due to plasticity, in comparison with the standard design procedure is made.

46287 (CONF-890993–2) **A parallel least squares collocation conjugate gradient approach for the advection diffusion equation.** Peters, A.; Pinder, G.F. Princeton Univ., NJ (USA). [1989]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60453. From 6. conference on computing in civil engineering; Atlanta, GA (USA); 11-13 Sep 1989. Order Number DE90015965. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents an accurate and very robust least squares collocation technique that allows one to employ the preconditioned conjugate gradient solution procedure and orthogonal meshes to the solution of the advection diffusion equation defined over domains with irregular shape. The new approach can achieve a reasonable fraction of the optimal performance of a wide variety of parallel architectures since most of its computational tasks are performed independently. 28 refs., 14 figs.

46288 (CONF-900791–1) **Neural nets and eddy-current testing.** Allen, J.D. Jr.; Dodd, C.V.; Pate, J.R.; Schell, F.M. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Review of progress in quantitative NDE; La Jolla, CA (USA); 15-20 Jul 1990. Order Number DE90016044. Source: NTIS, PC A02/MF A01 - OSTI.

Artificial neural networks of a novel type have been trained and tested on a variety of eddy-current flaw signals commonly occurring in nuclear reactor steam generators with the ultimate goal of emulating, at least crudely, the vision and reasoning capabilities of the human analyst. The network methodology itself was that of Allen and Schell developed originally for studies of such biologically relevant neural properties as cognitive complementarity and concept formation. Because they are so important to the results obtained, we discuss the general characteristics of the approach in the Preamble. In Section I we describe the relevant aspects of the neural network configuration presently in use and in Section II the method by which the artificial neural systems have been trained. Finally, we discuss results of the training process for systems explored.

46289 (CONF-900828–6) **Expanding the power of expert systems applications with neural networks.** Ferrada, J.J. (Oak Ridge National Lab., TN (USA)); Osborne-Lee, I.W.; Cuccuzzella, N. Oak Ridge National Lab., TN (USA). [1990]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Summer national meeting of the American Institute of Chemical Engineers; San Diego, CA (USA); 19-22 Aug 1990. Order Number DE90016032. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is well known that expert systems are useful in capturing expertise and applying knowledge to chemical engineering problems such as diagnosis, process control, process simulation, process advisory, etc. Traditionally, expert system applications are limited to knowledge domains that are heuristic and involve only simple mathematics. Neural networks however, represent an emerging technology capable of rapid recognition of patterned behavior without regard to mathematical complexity. Although useful in problem identification, neural networks are not very efficient in pointing to in-depth solutions and typically do not promote deep understanding of the problem or the reasoning behind its solutions. This paper explores the potential for expanding the scope of expert system applications by combining expert systems and neural networks. Specifically, this work demonstrates the use of knowledge that is pattern driven rather than heuristic and may be fuzzy, which is characteristic of many problems in chemical engineering. The feasibility of combining these two artificial intelligence (AI) technologies is explored through chemical engineering unit operations examples.

46290 (CONF-901017–2) **Knowledge-based expert system configurator.** Wakefield, K.A.; Gould, S.S. Oak Ridge National Lab., TN (USA). [1990]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International conference and exhibition of the Instrument Society of America; New Orleans, LA (USA); 14-19 Oct 1990. Order Number DE90011711. Source: NTIS, PC A02/MF A01 - OSTI.

The term "knowledge-based expert system" usually brings to mind a rather extensive list of commercially available expert system shells with the associated complexity of implementing the given inferencing strategies to drive a rule base of knowledge for solving particular classes of problems. A significant amount of learning time is required to understand all of the intricacies of the systems in order to effectively utilize their salient features while working around the "canned" constraints. The amount of effort required to prototype the "first attempt" is therefore substantial and can quickly lead to the unfortunate effect of reticence toward applying expert systems. This paper describes an alternative approach to use of specialized shells in developing or prototyping first-attempting knowledge-based expert systems using Lotus 123, a commonly used spreadsheet software package. The advantages of using this approach are discussed. The working example presented makes use of the forward-chaining capabilities available to determine automatically the hardware jumper and switch configuration for a distributed process control system. Hardware configuration control documentation is generated for use by field engineers and maintenance technicians. 4 refs., 4 figs.

46291 (CONF-9006260–1) **A compute-ahead implementation of the fan-in sparse distributed factorization scheme.** Ashcraft, C. (Boeing Computer Services Co., Seattle, WA (USA)); Eisenstat, S.C.; Liu, J.W.H.; Sherman, A.H.; Peyton, B.W. Oak Ridge National Lab., TN (USA). [1990]. 21p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. From 4. Canadian supercomputing symposium; Montreal (Canada); 4-6 Jun 1990. Order Number DE90016042. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, we consider a compute-ahead computational technique in the distributed factorization of large sparse matrices using the fan-in parallel scheme. Experimental results on an Intel iPSC/2 hypercube are provided to demonstrate the relevance and effectiveness of this technique. Fortran source code is also included in an appendix. 9 refs., 3 figs., 1 tab.

46292 (CRN-PN–89-23) **VME data acquisition system. Interactive software for the acquisition, display and storage of one or two dimensional spectra.** Petremann, E. Strasbourg-1 Univ.,

67 (France). Centre de Recherches Nucleaires. 1989. 109p. (In French). Order Number DE90514622. Source: NTIS (US Sales Only), PC A06/MF A01.

The development and construction of a complete data acquisition system for nuclear physics applications, are described. The system is based on the VME bus and the 16/32 bits microprocessor. The data acquisition system enables the obtention of line spectra, involving one or two parameters, and the simultaneous storage of events in a magnetic tape. The analysis and the description of the data acquisition software, the experimental spectra display and saving on magnetic systems are given. Pascal and Assembler are used. The development of cards, for the standard VME and electronic equipment interfaces, is performed.

46293 (DOE/ER/25006–4) **Computing environments, interactive graphics and nonparametric methods for data analysis: Progress report 1988–89 and Research plan 1989–90.** Washington Univ., Seattle, WA (USA). 1990. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER25006. Order Number DE90016127. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report discusses progress for the year 1988–1989 in computing environments, interactive graphics and nonparametric methods for data analysis. (LSP)

46294 (DOE/ER/25006–5) **Computing environments, interactive graphics and nonparametric methods for data analysis: Progress report 1989–90 and Research plan 1990–91.** Washington Univ., Seattle, WA (USA). [1991]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER25006. Order Number DE90016128. Source: NTIS, PC A03/MF A01 - OSTI.

This report discusses progress for the year 1989–1990 in computing environments, interactive graphics and nonparametric methods for data analysis. (LSP)

46295 (DOE/ER/25013–5) **Parallel and sparse methods for large-scale numerical optimization: Progress report.** Coleman, T.F.; Vavasis, S.A. Cornell Univ., Ithaca, NY (USA). 29 May 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER25013. Order Number DE90015655. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report discusses progress in parallel and sparse methods for large-scale numerical optimization of linear programming problems. (LSP)

46296 (DOE/ER/25026–36) **An algebraic hierarchical basis preconditioner.** Guo, R. Illinois Univ., Urbana, IL (USA). Dept. of Computer Science. May 1990. 42p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG02-87ER25026. Grant DMS 89-11410. Order Number DE90015875. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We consider the solution of linear system of equations $Ax = b$, where the coefficient matrix A satisfies the property: $A^T = A$, $a_{ij} \leq 0$ if $i \neq j$, and $\Sigma_j a_{ij} = 0$ for all i. A novel algebraic hierarchical basis preconditioner is introduced motivated partly by electrical network problems. This preconditioner gives rise a class of iterative methods, which we call clumping methods, to handle the linear system given above. A convergence proof is obtained for these methods and the convergence factor is also estimated. In addition, results of numerical experiment with clumping methods are presented.

46297 (DOE/ER/25026–37) **Linear iterative solvers for implicit ODE methods.** Saylor, P.E.; Skeel, R.D. Illinois Univ., Urbana, IL (USA). Dept. of Computer Science. 24 Apr 1990. 24p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG02-87ER25026. Grant DMS 89-11410. (CONF-9004231–2: Conference on iterative methods, Copper Mountain, CO (USA), 1-5 Apr 1990). Order Number DE90015874. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we consider the numerical solution of stiff initial value problems, which lead to the problem of solving large systems of mildly nonlinear equations. For many problems derived from engineering and science, a solution is possible only with methods derived from iterative linear equation solvers. A common approach to solving the nonlinear equations is to employ an approximate solution obtained from an explicit method. In this paper we shall examine the error to determine how it is distributed among the stiff and non-stiff components, which bears on the choice of an iterative method. Our conclusion is that error is (roughly) uniformly distributed, a fact that suggests the Chebyshev method (and the accompanying Manteuffel adaptive parameter algorithm). we describe this method, also commenting on Richardson's method and its advantages for large problems. We then apply Richardson's method and the Chebyshev method with the Manteuffel algorithm to the solution of the nonlinear equations by Newton's method. 25 refs.

46298 (DOE/ER/25080–1) **[Annual report of the Board on Mathematical Sciences].** National Research Council, Washington, DC (USA). Board on Mathematical Sciences. [1990]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER25080. Order Number DE90015118. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is a progress report on the activities of the Board on Mathematical Sciences (BMS) of the Commission on Physical Sciences, Mathematics, and Applications, National Research Council (NRC), for the first year of the above referenced grant for Board core support, and a request to the Department of Energy (DOE) for the second year of funding in the amount of $31,110 under that grant for the period August 1, 1990–July 31, 1991. In awarding this grant in 1989, the DOE and other member agencies of the Interagency Committee on Extramural Mathematics Programs (ICEMAP) established levels of total ICEMAP core support for the Board over the referenced three-year period and corresponding levels of total support and support by year from the six participating ICEMAP agencies (AFOSR, ARO, DOE, NSA, NSF, and ONR). The amount requested herein and the activities proposed for the coming second year of support correspond to those set in 1989 during deliberations on the three-year proposal. As this request is for the second year of funding for activities covered by a three-year proposal and award, this report is limited to an update of progress over the first year and plans for the second year. As the original proposal provided a progress report through calendar year 1988 and plans for calendar year 1989, this report presents the progress for 1989 to March 1990, and plans for 1990–1991. The Board, with its committees and panels, expended considerable energy along several fronts in 1989. This will result in the release of 18 publications, in addition to the anticipated start-up of five new studies leading to reports.

46299 (ETDE-IT–90-51) **The ENEA contribution to the ENEA-CRP international comparison of codes for radiation protection assessment of spent fuel transport flasks.** Gualdrini, G.F.; Burn, K.W.; Casalini, L.; Peerani, P. Io. ENEA, Bologna (Italy). Sep 1988. 7p. (CONF-880906–16: 7. international conference on radiation shielding, Bournemouth (UK), 12-16 Sep 1988). Order Number DE90514526. Source: NTIS (US Sales Only), PC A02/MF A01.

Paper presented at the 7th international conference on radiation shielding (Bournemouth, 12-16 Sep 1988).

This paper decribes the methodology employed and discusses the results obtained so far by the ENEA delegation in the framework of an international intercomparison of codes for the shielding analysis of spent fuel transport flasks, still underway.

46300 (IPNO-AGOR–01-89) **Manual for the program Canal_3D.** Gustafsson, S. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 24p. Order Number DE90514636. Source: NTIS (US Sales Only), PC A03/MF A01.

The AGOR group is building a superconducting cyclotron. In general, only the vertical field in the median plane of an electromagnetic channel is calculated. The extremities can be approximated with horizontal bars perpendicular to the beam. This is followed by a Taylor series development to calculate the components outside the median plane. This method cannot be used in our case since the sources of the magnetic field are too close to the beam. In a case where the extremities of the channel play an important role (for example with superconducting coils), these have to be represented in a more precise way. These are the main reasons for the development of a new program called $CANAL_3D$. Two other programs CANALIN and CANALYS assure the necessary support. All 3 programs have an interactive dialog with the user. Those dialogues can be written in a command file, which can be submitted in BATCH. The graphic routines works only on the VAX system.

46301 (KCP–613-4172) **Bidirectional translator between DXF and IGES formats: Final report.** Bradford, J.R. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Aug 1990. 46p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE90016430. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Software was conceived that provided two-way CAD data exchange between AuotCAD's DXF format and the IGES format. Obstacles were found with a newly emerging DXF format, and enhancements were added to accommodate multiple DXF forms. Successful code was written using the C programming language, thus providing portability to other hardware. Future enhancements to the code were identified. 4 refs.

46302 (K/CSD/TM–94) **Automated CADAM data transfer: User's manual.** Holder, D.A.; Schwarz, R.K. Oak Ridge Gaseous Diffusion Plant, TN (USA). Jul 1990. 24p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE90014871. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This manual describes the Automated Data Transfer program developed at Martin Marietta Energy Systems, Inc., to provide an enhanced method for transferring CADAM® drawings in both directions between MICRO CADAM™ on the personal computer (PC) and CADAM on the mainframe. Section 2.0 of this manual presents an overview of the Automated CADAM Data Transfer program, describing the program's purpose; the data that it handles; the functions it performs; the hardware, software, and access requirements; and help and error functions. Section 3.0 describes the interactive menu-driven operation of the automated CADAM Data Transfer program.

46303 (LA–11732-M) **A manual for microcomputer image analysis.** Rich, P.M. (Stanford Univ., CA (USA). Dept. of Biological Sciences); Ranken, D.M.; George, J.S. Los Alamos National Lab., NM (USA). Dec 1989. 76p. Sponsored by National Science Foundation. DOE Contract W-7405-ENG-36. Grant BSR86-14769. Order Number DE90015629. Source: NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This manual is intended to serve three basic purposes: as a primer in microcomputer image analysis theory and techniques, as a guide to the use of IMAGE©, a public domain microcomputer program for image analysis, and as a stimulus to encourage programmers to develop microcomputer software suited for scientific use. Topics discussed include the principals of image processing and analysis, use of standard video for input and display, spatial measurement techniques, and the future of microcomputer image analysis. A complete reference guide that lists the commands for IMAGE is provided. IMAGE includes capabilities for digitization, input and output of images, hardware display lookup table control, editing, edge detection, histogram calculation, measurement along lines and curves, measurement of areas, examination of intensity values, output of analytical results, conversion between raster and vector formats, and region movement and rescaling. The control structure of IMAGE emphasizes efficiency, precision of measurement, and scientific utility. 18 refs., 18 figs., 2 tabs.

46304 (LA-UR–90-776) **QTA [Questionnaire-Task-Analysis]: An electronic tool for job/task analysis.** Houghton, F.K.; Fries, R.J. Los Alamos National Lab., NM (USA). [1990]. 5p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901055–1: Association for the Development of Computer-based Instruction Systems (ADCIS) meeting, San Diego, CA (USA), 29 Oct - 1 nov 1990). Order Number DE90008944. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

When a computer-based training (CBT) package is part of a performance-based training system, a job/task analysis (JTA) to identify and document training requirements is the first step. To identify and document training requirements, performance-based training mandates that a job/task analysis be completed. To simplify the task of performing the job/task analysis for the control room operators at the plutonium facility at Los Alamos National Laboratory, we wrote the MODULA-2 program QUESTIONNAIRE-TASK-ANALYSIS (QTA). Because we were performing the job/task analysis to meet the requirements of DOE Order 5480.18, the programming was based on the documentation presented in the DOE documents Training Accreditation Program Manuals (TAP 1, TAP 2, and TAP 3). The model for the questionnaire portion of the program was Attachment I-8, page I-33, of TAP 2-88. The analysis that recommends no-train, train or overtrain uses the decision tree on page I-10 of TAP 2-88. However, the program is useful beyond just compliance with the Order. The program performs two functions: it collects numerical data from a questionnaire with a rating scale, and it analyzes the data. After the data are collected, the analysis portion uses a decision tree to make training recommendations. The data may be collected using a long form or a short form of the questionnaire. The analysis procedure creates three analysis files based on job classifications of the respondents. Because of the dual capabilities of the program, QTA may be used by a respondent to complete the questionnaire or the analyst to analyze the results of the survey. Before discussing the QTA program in detail, we will briefly review the process of performing a job task analysis. 5 refs.

46305 (LA-UR–90-2042) **LAVA/CIS Version 2.0: A software system for vulnerability and risk assessment.** Smith, S.T. Los Alamos National Lab., NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9010121–1: 13. national computer security conference, Washington, DC (USA), 1-4 Oct 1990). Order Number DE90013169. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

LAVA (the Los Alamos Vulnerability/Risk Assessment system) is an original systematic approach to risk assessment developed at the Los Alamos National Laboratory. It is an alternative to existing quantitative methods, providing an approach that is both objective and subjective, and producing results that are both quantitative and qualitative. LAVA was developed as a tool to help satisfy federal requirements for periodic vulnerability and risk assessments of a variety of systems and to satisfy the resulting need for an inexpensive, reusable, automated risk assessment tool firmly rooted in science. LAVA is a three-part systematic approach to risk assessment that can be used to model a variety of application systems such as computer security systems, communications security systems, information security systems, and others. The first part of LAVA is the mathematical model based on classical risk assessment, hierarchical multilevel system theory, decision theory, fuzzy possibility theory, expert system theory, utility theory, and cognitive science. The second part is the implementation of the mathematical risk model as a general software engine executed on a large class of personal computers. The third part is the application data sets written for a specific application system. The user of a LAVA application is not required to have knowledge of formal risk assessment techniques. All the technical expertise and specialized knowledge are built into the software engine and the application system itself. 36 refs., 5 figs.

46306 (LA-UR–90-2082) **Network security and the graphical representation model.** Dreicer, J.S.; Stolz, L.; Smith, W.A. Los Alamos National Lab., NM (USA). [1990]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9010121–2: 13. national computer security conference, Washington, DC (USA), 1-4 Oct 1990). Order Number DE90013162. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the underlying conceptual design and investigative approach used during the development of the Prototype Graphical Representation Model. The initial problem was to characterize and develop the fundamental theoretical foundation for modeling the features of computer networks. This research was influenced by the desire to investigate graph theoretical problems, in general, that are common to many different systems and disciplines. A computer network is a specific graph theoretical problem. This paper provides details on the early research into the relation between computer networks and graph theory and the optimal representation of computer networks for security analysis. 18 refs., 3 figs.

46307 (LA-UR–90-2614) **An interpersonal multimedia visualization system.** Phillips, R.L. Los Alamos National Lab., NM (USA). [1990]. 4p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-901089–2: Visualization '90, San Francisco, CA (USA), 23-26 Oct 1990). Order Number DE90014974. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Media View is a computer program that provides a generic infrastructure for authoring and interacting with multimedia documents. Among its many applications is the ability to furnish a user with a comprehensive environment for analysis and visualization. With MediaView the user produces a "document" that contains mathematics, datasets and associated visualizations. From the dataset or embedded mathematics animated sequences can be produced in situ. The mathematical content of the "document" can be explored through manipulation with Mathematica ™. Since the "document" is all digital, it can be shared with a co-worker on a local network or mailed electronically to a colleague at a distant site. Animations and any other substructure of the "document" persist through the mailing process and can be awakened at the destination by the recipient. 5 refs., 4 figs.

46308 (ORNL/FTR–3688) **[The 1990 ACM International conference on supercomputing]: Foreign trip report, June 9, 1990–June 29, 1990.** Heath, M.T. Oak Ridge National Lab., TN (USA). 25 Jul 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015136. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The travelers attended the 1990 ACM International Conference on Supercomputing and the Householder Symposium XI on Numerical Algebra. Both conferences featured many presentations and other activities of particular interest to ORNL research programs in parallel computing and numerical linear algebra. At the ACM Conference, M. T. Heath served on the program committee, chaired a session, sat on a panel discussion on parallel programming environments, and participated in a formal software demonstration session in which he demonstrated performance visualization software developed at ORNL. At the Householder Symposium, E. G. Ng presented a talk on computing supernodes in sparse matrix factorization. All three travelers held numerous technical discussions on issues having direct relevance to ORNL research programs.

46309 (ORNL/FTR–3700) **[Developing tools for performance visualization of parallel algorithms]: Foreign trip report, July 28, 1990–August 5, 1990.** Heath, M.T. Oak Ridge National Lab., TN (USA). 10 Aug 1990. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90015801. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the 1990 IBM Europe Institute in Oberlech, Austria. The conference featured many presentations and other activities of interest to ORNL research programs in parallel computing, particularly in the area of parallel software support tools. The traveler presented to talk on his work at ORNL in developing tools for performance visualization of parallel algorithms. The traveler held numerous technical discussions on issues having direct relevance to ORNL research programs.

46310 (ORNL/FTR–3703) **[Sparsity in large scale scientific computation]: Foreign trip report, August 3, 1990–August 11, 1990.** Ng, E.G. Oak Ridge National Lab., TN (USA). 20 Aug 1990. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90016515. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended a conference organized by the 1990 IBM Europe Institute at Oberlech, Austria. The theme of the conference was on sparsity in large scale scientific computation. The conference featured many presentations and other activities of direct interest to ORNL research programs on sparse matrix computations and parallel computing, which are funded by the Applied Mathematical Sciences Subprogram of the DOE Office of Energy Research. The traveler presented a talk on his work at ORNL on the development of efficient algorithms for solving sparse nonsymmetric systems of linear equations. The traveler held numerous technical discussions on issues having direct relevance to the research programs on sparse matrix computations and parallel computing at ORNL.

46311 (PNL-SA–17302) **A representation scheme for fault diagnosis of physical systems.** Stratton, R.C. Pacific Northwest Lab., Richland, WA (USA). Jun 1990. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900607–6: Advances in human factors research on man-computer interactions: nuclear and beyond, Nashville, TN (USA), 10-15 Jun 1990). Order Number DE90016362. Source: NTIS, PC A02/MF A01 - OSTI.

For the most part those of use who operate simple machines do so in a run-till-breakdown mode. But, because of safety and and economic concerns, society cannot afford to operate complex machines in this run-till-breakdown mode. An alternate to operating in this mode is the predictive-corrective mode. A principal element in the predictive-corrective mode is the determination of system behavior and the analysis of the implications of that behavior. In this paper, we discuss a representation scheme used to model and execute knowledge for reasoning about fault behavior in physical systems. The representation scheme consists of a function hierarchy of the physical system, object hierarchies of components found in physical systems, a generalized inference methodology for determining component and system performance, and a task control scheme that allows concurrent and integrated reasoning during fault diagnosis. 11 refs., 6 figs.

46312 (PNL-SA–18089) **A method for developing integrated numeric and symbolic models for fault diagnostic reasoning.** Stratton, R.C.; Jarrell, D.B. Pacific Northwest Lab., Richland, WA (USA). Jul 1990. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-900793–3: AAAI '90: 8. national conference on artificial intelligence, Boston, MA (USA), 17 Jul - 3 aug 1990). Order Number DE90016287. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Model-based reasoning is a developing area of study in the artificial intelligence community. We believe that a model-based reasoner consists of two major elements; a cognitive element and an artifact element. The cognitive element models and provides for the cognitive activities and inference methods ascribed tc the reasoning task. The artifact element models information about the artifact, such as structure and function. This paper discusses our methodology for developing and integrating numeric and symbolic models for reasoning about physical system faults. In this paper we only discuss our method for developing the artifact model which we designate the system-process model.

46313 (RFP–4419) **Utilizing video animation to present FEA [Finite Element Analysis] results.** Hayer, L.K.; Vossler, J.J. III. EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant. [1990]. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-9009231–1: MARC finite element analysis users conference, Monterey, CA (USA), 20-21 Sep 1990). Order Number DE90015675. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Finite element Analysis (FEA) technique are used to analyze forming, rolling, extrusion, and other continuous manufacturing processes to produce solutions at discrete points in time. These solutions are then displayed using a graphical post-processor. The post-processor displays one plot at a time making it difficult to follow events over the entire process. A means of linking these images that occur at discrete points in time and displaying them in a continuous fashion would aid in comprehending the significance of dynamic or time dependent events that evolve during the processes. Video recording of the graphics provides a means to link the graphical ouput at each discrete point in time and project the results in a continuous fashion upon playback. This presentation outlines the video hardware, the modifications to the pre- and post-processing software, and the process used to make video animation recording of FEA results. Several examples will be shown: "Hydroforming of a Spherical Aluminum Shell" and "Three-Stage Forging." 5 refs., 7 figs.

46314 (SAND–88-3158-Rev.) **User's manual for the Trajectory Simulation and Analysis Program (TSAP): Revised.** Outka, D.E. Sandia National Labs., Albuquerque, NM (USA). 31 Jul 1990. 149p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC04-76DP00789. Order Number DE90014850. Source: NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Trajectory Simulation and analysis Program (TSAP) provides a generalized package for studying point-mass trajectory problems. TSAP expands upon the input and output features of the code PMAST, from which it is derived. All important features, such as trajectory segmentation, iterative parameter searches and surveys, user defined output values, and target vehicle simulation, have

been maintained and often improved. Differences include the ways in which vehicle orientation can be defined, the free format table input option, the coordinate systems for initial condition specification, and the capability to simulate vehicle launch from zero velocity. This report documents the mathematical basis of the trajectory simulation and explicitly defines the input and output variables. General input gruidelines and examples are also presented.

46315 (SAND–90-0743C) **FUSION [Familiar User-System Interface OperatioN]: A plan for developing a familiar user-system interface for the IC fabrication industry.** Miller, D.P. Sandia National Labs., Albuquerque, NM (USA). [1990]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9010158–1: 9. IEEE/CHMT international electronics manufacturing technology symposium, Washington, DC (USA), 1-3 Oct 1990). Order Number DE90015170. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In spite of the best efforts of designers and the power of today's computer workstations, many user-system interfaces (USIs) found in IC-fabrication equipment are not very user-friendly. Hence, for many complex, IC-fabrication machines, extensive training programs, thick user manuals, and operator confusion have become a way of life. Since many users must interact with several machines or several types of machines, inter-equipment inefficiencies arise due to negative transfer of training. This paper discusses the concept of developing a set of industry guidelines for a familiar USI for IC-fabrication equipment called FUSION (for Familiar User-System Interface Operation N). A familiar USI across the industry would allow process engineers, operators, and service technicians to learn only one set of interface conventions. Successful standardization would lead to reduced training time and operational errors, faster recipe editing, more rapid fault diagnosis and repair, and reduced personnel specialization. This paper addresses the need and potential benefits of FUSION, identifies some of the major technical challenges to developing such an interface, and proposes a developmental approach that would systematically create, test, and validate candidate designs. The author hopes that this paper will also stimulate spirited discussion of the FUSION concept within the industry. 8 refs., 3 figs.

46316 (SAND–90-0985C) **Small multipurpose stored data acquisition system.** Hauser, G.C.; Ryerson, D.E. Sandia National Labs., Albuquerque, NM (USA). [1990]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-901074–1: International telemetering conference, Las Vegas, NV (USA), 29 Oct 1990). Order Number DE90010823. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories Telemetry Department has designed and is fielding a small, inexpensive multipurpose stored data acquisition system in tests ranging from 6000 meters below the ocean surface in seafloor penetrators to 40,000 meters above sea level in gamma ray telescope balloons. The systems consists of a simple microprocessor-controlled unit which digitizes analog data stores the data in memory for readout after the test by a portable personal compute. The system has been used in over ninety tests consisting of parachute drops, water entry test, vehicle environmental monitoring, and seafloor penetration tests. Data typically recorded with the system are acceleration, strain, temperature, pressure, and angular velocity. The system is also capable of generating control functions such as parachute release. 5 refs., 6 figs.

46317 (SAND–90-1551C) **PLZT optical information storage devices.** Land, C.E.; Schwartz, R.W.; Butler, M.A.; Martin, S.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-900643–1: IEEE international symposium on applications of ferroelectrics, Urbana, IL (USA), 6-8 Jun 1990). Order Number DE90015717. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The application of ferroelectric thin films to optical information storage devices depends first on their capability to store optical information, i.e., their intrinsic and/or extrinsic photosensitivities, and then upon some means of detecting and reading the stored optical information with a reasonable signal-to-noise ratio. Based on the method of reading the stored information, the latter capability depends either on the magnitude of the longitudinal electrooptic coefficients or the photocurrent generation efficiency of the films. This paper briefly discusses PZT and PLZT thin film longitudinal electrooptic effects, photosensitivities and photocurrent generation characteristics and some proposed optical information storage devices which will use these properties. 18 refs., 5 figs., 1 tab.

46318 (SAND–90-2036C) **A simple, statistically based methodology for system tuning.** Benson, M.J. Sandia National Labs., Albuquerque, NM (USA). [1990]. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9007146–1: SHARE (IBM user's group), New Orleans, LA (USA), 12 Jul 1990). Order Number DE90015391. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

System tuning often occurs in response to observed changes in key performance indicators. But, how do we determine if a change is significant? Our indicators are random variables. They display a "natural" variation. This presentation reviews techniques that may provide a great deal of assistance in determining the significance of a change – and more importantly – when and what to tune. The techniques were developed by Dr. William Shewhart at Bell Labs and refined by internationally known quality specialist W. Edwards Deming. Although founded on statistical theory, the techniques are easy to use, require no formal statistical training, and may help you!

46319 (SAND–90-2066C) **Performance and operational characteristics of a Fiber Distributed Data Interface (FDDI) ring.** Testi, N. Sandia National Labs., Albuquerque, NM (USA). [1990]. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9009232–2: 23. NEXUS conference, Orlando, FL (USA), 11-14 Sep 1990). Order Number DE90016103. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories is in the process of upgrading the Central Computing Network, which is a large heterogeneous network providing scientific computing, file storage, output services, and remote access to network resources. The migration from the present HYPERchannel-50 technology to HYPERchannel-100 is currently in progress and plans to migrate to the Fiber Distributed Data Interface (FDDI) token ring architecture are being considered. A migration from a variety of proprietary protocols to a primarily TCP/IP environment is also in progress. In order to test the feasibility of the Network Systems Corporation FDDI technology platform, two test rings have been constructed. Ring 'A' consists of nine dual attached Data Exchange Units (DXUs) and ring 'B' consists of two dual attached DXUs. The rings are linked together using N715 DXUs. Other DXU models (with associated host computers where applicable) include N130s, an N220, N400s, and FE640 IP routers. Test data on fault isolation and recovery mechanisms, performance, IP routing (within and between rings), and monitor capabilities will be presented. 'Interoperability' data based on tests between DXUs and Sun FDDI workstations will also be presented. 14 figs.

46320 (SAND–90-2067C) **Design and implementation of a Fiber Distributed Data Interface (FDDI) cable plant and network.** Gossage, S.A.; Testi, N. Sandia National Labs., Albuquerque, NM (USA). [1990]. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90016102. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An extensive optical fiber (o.f.) cable plant has been constructed in the Central Computing Facility (CCF) of Sandia National Labs to support the NSC DX platform with the Fiber Distributed Data Interface (FDDI) network. The cable plant was designed to optimize flexibility, maintainability, expandability, performance, and capacity. More than 2km of fiber cable and over 3400 connectors were installed. Each component of the cable system was carefully evaluated in order to meet the design requirements and conform to standards. A detailed statement of work (SOW) was generated to assure proper implementation of the design by a qualified contractor. Following the installation of the o.f. cable plant, a heterogenous, production network was built to utilize the benefits of the new media and interfaces.

46321 (SOL–90-10) **Pseudo-monotone complementarity problems in Hilbert space.** Cottle, R.W.; Yao, Jen-Chih. Stanford Univ., CA (USA). Systems Optimization La... Jul 1990. 19p. Sponsored by U.S. Department of Defense; U.S. DOE Energy

Research. DOE Contract FG03-87ER25028. Grant DMS 8913089;Grant N00014-89-J-1659. Order Number DE90016310. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, some existence results for a nonlinear complementarity problem involving a pseudo-monotone mapping over an arbitrary closed convex cone in a real Hilbert space are established. In particular, some known existence results for a nonlinear complementarity problem in a finite-dimensional Hilbert space are generalized to infinite-dimensional real Hilbert space. Applications to a class of nonlinear complementarity problems and the study of the post-critical equilibrium state of thin elastic plate subjected to unilateral conditions are given.

46322 (UCRL-ID-104689) **Responding to computer security incidents: Guidelines for incident handling.** Schultz, E.E. Jr.; Brown, D.S.; Longstaff, T.A. Lawrence Livermore National Lab., CA (USA). 23 Jul 1990. 67p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90016654. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

These guidelines do not comprise an exhaustive set of incident handling procedures. A lengthy set of guidelines would be too intimidating to read and to incorporate into site contingency response plans. The discipline of responding to incidents is also very much in its infancy. Because so much is yet to be learned about handling incidents, this version of these guidelines will necessarily lack some degree of sophistication and detail. In addition, it is impossible to specify specific technical procedures for responding to the many types and versions of computer systems within DOE. This guidelines document contains basic information about responding to incidents which can be used, regardless of hardware platform or operating system. For specific technical details necessary to implement many of the recommendations in these guidelines, consult your system administrator or vendor.

46323 (UCRL-JC-104630) **Unstructured mesh relaxation.** Crowley, W.P. Lawrence Livermore National Lab., CA (USA). May 1990. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9006195-8: Free Lagrange conference, Jackson Lake, WY (USA), 3-7 Jun 1990). Order Number DE90015614. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The relationship between the human asking questions and the code providing answers is being revised currently; the trend is toward a situation wherein each partner does what he/she/it does best. The human excels at processes requiring thought, such as analyzing the results of a simulation, and organizing lists of things to do and guidelines for doing them. Currently, the computer excels at following instructions and doing tedious, repetitive tasks without error. Thus, the human should ask the questions – set up geometries – specify boundary and source conditions – and analyze the results. The code should decide, dynamically, during the evolution of the problem, where to refine the mesh and which algorithms to use in which regions of the problem in order to provide both accuracy and robustness. The ultimate code will be based on an unstructured mesh. It will involve the ability to do Free-Lagrange and ALE (Arbitrary-Langrangian-Eulerian) and it will dynamically adapt the mesh to suit the problem at hand. It will be capable of adopting other hydro algorithms and of including other physics options. At its heart will be a mesh manager that will decide which option is appropriate for each region of the problem. Free-Lagrange methods, ALE on a structured mesh, and adaptation are existing technologies. ALE requires a method for relaxing the mesh in regions of high fluid distortion and we do not yet have a robust method for relaxing an unstructured mesh. This paper addresses that problem.

46324 (UCRL-JC-104693) **Domain decomposition: An instrument of asymptotic-numerical methods.** Chin, R.C.Y.; Hedstrom, G.W. Lawrence Livermore National Lab., CA (USA). 1 Aug 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9002131-2: Workshop on asymptotic analysis and numerical solution of partial differential equations, Argonne, IL (USA), 26-28 Feb 1990). Order Number DE90016478. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We give several examples showing the use of asymptotic analysis in the construction of numerical methods based on domain decomposition. Many of the examples come from singularly-perturbed convection-diffusion equations with boundary and internal layers. Our final example is less standard in that it deals with the numerical generation of orthogonal polynomials.

46325 (UCRL-LR-103745) **A comparison of conjugate gradient, SIP, and other iterative methods for the solution of Poisson's equation with irregular boundary conditions.** Bergmann, D.J. Lawrence Livermore National Lab., CA (USA). Jun 1990. 69p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90015603. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Several well known iterative methods for solving Poisson's equation, including Strongly Implicit Procedure and several preconditioned conjugate gradient methods are first applied to a problem with simple boundary conditions and a known solution. Then a problem with more complicated boundary conditions, similar to those encountered when modeling AVLIS plasmas, is solved. Differences in the solutions of the various methods are examined through the use of Fourier analysis. It was found that combinations of different iterative schemes will in some cases be the most efficient method of solution. 22 refs., 29 figs.

9903 Information Handling

Refer also to citation(s) 44427, 44611, 45216, 46225, 46307

46326 (DOE/ER-0466P) **FEDIX: An on-line information service for universities and other research organizations: User's guide: Version 3.0, Release 1.0.** USDOE Office of Energy Research, Washington, DC (USA). Sep 1990. 56p. Sponsored by U.S. DOE Energy Research. Order Number DE90014835. Source: NTIS, PC A04/MF A01 - OSTI; GPO Dep.

FEDIX is an on-line information service that links the higher education community and the federal government to facilitate research, education, and services. The system provides accurate and timely federal agency information to colleges, universities, and other research organizations. There are NO REGISTRATION FEES and NO ACCESS CHARGES for using FEDIX. The only cost is for the phone call. Currently FEDIX contains information on the Department of Energy (DOE), Office of Naval Research (ONR), and National Aeronautics and Space Administration (NASA). Additional government agencies are expected to join FEDIX in the future. This guide is intended to help users access and utilize the FEDIX system. Because the system requires frequent updating, however, some menus and tables used in this text as examples may not exactly match those displayed on the on-line system.

46327 (JAERI-M-90-025, pp. 167-168) **Status of the demand for charged particle nuclear data.** Matsunobu, Hiroyuki (Sumitomo Atomic Energy Industries Ltd., Tokyo (Japan). Tokyo Office). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182-: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)-149/U; INDC(JPN)-136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

The Working Group on Charged Particle Nuclear Data was organized this year to prepare the data files on nuclear reactions induced by the charged particles. In advance of start of the activity, it is necessary to know the demand from the users of charged particle nuclear data in the various fields. This information was collected through the lectures in the special meeting of sigma and reactor physics committees and in working group meeting, and private communication. The outline of the status is as follows. (author).

46328 (JAERI-M-90-025, pp. 169-178) **Compilation of charged particle nuclear reaction database and database conversion for international coordination.** Chiba, Masaki (Hokkaido Univ., Sapporo (Japan). Computing Center). Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182-: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)-149/U; INDC(JPN)-136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

Practice for the past more than fifteen years of NRDF activity in compilation and international exchange of charged particle nuclear

reaction data and their current status is reported. The way of the practice comprises major two parts: the one is to have its own data compiling format and data storage and retrieval system named NRDF for the need of regional users; the other is to have database translator from NRDF into EXFOR for the international data exchange. The attainment of NRDF is discussed against the conditions issued for a database used from outside. (author).

46329 (JAERI-M–90-025, pp. 233-240) **Technological problem in development of an advanced support system for nuclear data evaluation.** Iwasaki, S. (Tohoku Univ., Sendai (Japan). Faculty of Engineering); Sugiyama, K. Japan Atomic Energy Research Inst., Tokyo (Japan). Feb 1990. (CONF-8911182–: 1989 seminar on nuclear data, Tokai (Japan), 16-17 Nov 1989; NEANDC(J)–149/U; INDC(JPN)–136/L). In *Proceedings of the 1989 seminar on nuclear data.* Order Number DE90008196. Source: NTIS (US Sales Only), PC A18/MF A01.

We have discussed the important issues of the technologies which are essential to develop the upgraded (high level) support system for the neutron nuclear data evaluation. However, if we focus to systematized knowledge of the evaluators, which is shallow or deep, and intend to build a cooperative problem solving system between user and machine, the system would be in the extension of the presently developed technologies. An experimental system which can be practically used for the evaluation process would be developed within several years. In order to make the system work efficiently, several data bases and management systems should be prepared; the cross section request data base, the data base for experimental cross sections from the EXFOR file, nuclear model/method/code data bases, and model parameter data base. Development of knowledge acquisition mechanism and natural language interface are very interesting themes in the application of the knowledge engineering technology to the data evaluation, but may be future problems. It is expected that present discussion would provide a useful guidance on the project for the practical system using artificial intelligence technology at JAERI nuclear data center. (author).

46330 (LA-UR–90-2604) **Common problems in the elicitation and analysis of expert opinion affecting probabilistic safety assessments.** Meyer, M.A.; Booker, J.M. Los Alamos National Lab., NM (USA). [1990]. 16p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-9009226–1: Committee on safety of nuclear installations (CSNI), Santa Fe, NM (USA), 4-6 Sep 1990). Order Number DE90014975. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Expert opinion is frequently used in probabilistic safety assessment (PSA), particularly in estimating low probability events. In this paper, we discuss some of the common problems encountered in eliciting and analyzing expert opinion data and offer solutions or recommendations. The problems are: that experts are not naturally Bayesian. People fail to update their existing information to account for new information as it becomes available, as would be predicted by the Bayesian philosophy; that experts cannot be fully calibrated. To calibrate experts, the feedback from the known quantities must be immediate, frequent, and specific to the task; that experts are limited in the number of things that they can mentally juggle at a time to 7 ± 2; that data gatherers and analysts can introduce bias by unintentionally causing an altering of the expert's thinking or answers; that the level of detail the data, or granularity, can affect the analyses; and the conditioning effect poses difficulties in gathering and analyzing of the expert data. The data that the expert gives can be conditioned on a variety of factors that can affect the analysis and the interpretation of the results. 31 refs.

46331 (LBL–27435) **Selectivity estimation in temporal databases.** Gunadhi, H. (Lawrence Berkeley Lab., CA (USA)); Segev, A.; Shanthikumar, J.G. Lawrence Berkeley Lab., CA (USA). Feb 1990. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90014888. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Temporal relations possess several characteristics that distinguish them from conventional snapshot relations. First, for each instance of the surrogate (entity) there is a set of time-ordered tuples. Second, surrogate instances may arrive and depart in some time-dependent manner. Third, the surrogate instance may arrive and depart more than once, thus creating gaps (null values) within its history. Lastly, the value of the temporal attribute may also be time-dependent. Conventional methods of estimation are incapable of providing good approximations of the cost of various temporal operations, even for those involving selections on a single relation. The problem is more acute in the case of join operations, since selectivities on time interval intersections have to be estimated. We propose a practical, yet theoretically sound model to characterize the behavior of temporal relations. Estimates of the outcome for various unary and binary operations are derived from this model. Preliminary results on the accuracy of selected estimates are provided. 19 refs., 4 figs.

46332 (LBL–28798) **Efficient indexing methods for temporal relations.** Gunadhi, H. (Lawrence Berkeley Lab., CA (USA)); Segev, A.; Haas, W.A. Lawrence Berkeley Lab., CA (USA). Mar 1990. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90014891. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The size of temporal databases and the semantics of temporal queries pose challenges for the design of efficient indexing methods. We look at the primary issues that affect the design of indexing methods, and propose several structures and algorithms for specific cases. We develop indexing methods for time based queries, queries on the surrogate or time-invariant key and time, and temporal attribute and time. In the latter case, we present several methods by which to partition the time-line, in order to balance the distribution of tuple-pointers within the index. We analyze our methods against alternatives, and present appropriate empirical results.

46333 (SLAC-PUB–5260) **Data flow integration for geodetic applications.** Ruland, D. (Kiel Univ. (Germany, F.R.). Dept. of Computer Science); Ruland, R. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1990. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90014806. Source: NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Geodetic applications even for a defined project consist of various different activities, and access a vast amount of heterogeneous data. Geodetic activities need a hybrid and heterogeneous hardware environment. This paper gives a brief introduction to the geodetic data flow using a sample application in survey engineering data. It states a general multi-level integration model providing an open system architecture. The model yields the GEOMANAGER project. Its data management aspect is addressed by this paper. 6 refs., 5 figs.

46334 (UCRL-CR–104622) **Jade data transcription system final report.** Eaton, R. (TRW, Inc., Redondo Beach, CA (USA). Advanced Technology Div.); Iskra, M.; McLean, J. Lawrence Livermore National Lab., CA (USA). 25 Jul 1990. 10p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90015748. Source: NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The OWL sensor, which is used in conjunction with the Jade program, generates a tremendous volume of data during normal field operations. Historically, the dissemination of this data to analysts has been slowed by difficulties in transcribing to a widely readable media and format. TRW, under contract from Lawrence Livermore National Laboratory, was tasked by Defense Advanced Research Projects Agency (DARPA) with finding an improved method of transcribing the Jade experimental data. During the period of performance on this contract TRW helped to guide the development and operation of an improved transcription system. This final report summarizes the work performed, and provides a written record of information which may be helpful to future users of the newly developed data transcription system. 4 figs.

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Micropore diffusion in coal chars under reactive conditions: Final technical report, 15:43664 (R;US)

Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene
Testing measurement systems for finding radioactive sources - documentation of aircraft measuring missions flown in September 1988, 15:45154 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Chances and scale of reducing emissions of air pollution by new environmental protection technologies. Final report, 15:45276 (R;DE;In German)
Development of efficient tandem solar cells on the basis of thin polycrystalline semiconductor films. Final report, 15:44128 (R;DE;In German)
Investigation of fission product retention by the HTR reactor protection building by the vented confinement concept, 15:44316 (R;DE;In German)
Long-term leaching of spent fuel in rock salt and quinary brine and the influence of iron on mobilization of elements. Final report, 15:43954 (R;DE;In German)
Low pressure plasma spraying (LPPS) of coatings to give protection against corrosion by hot-gases. Final report, 15:44640 (R;DE)

Bundesministerium fuer Umwelt-, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)
Aims and procedures used for the evaluation of research results in the field of nuclear safety with regard to the application of the Atomic Energy Law. Vol. 3, 15:44319 (R;DE;In German)
Data and information on foreign nuclear fuel reprocessing plants, 15:43908 (R;DE;In German)
Organization of radiation protection in German nuclear power stations, 15:44318 (R;DE;In German)
Testing measurement systems for finding radioactive sources - documentation of aircraft measuring missions flown in September 1988, 15:45154 (R;DE;In German)

Bureau of Land Management, Lewistown, MT (USA). Lewistown District Office
Blackleaf environmental impact statement. Draft report, 15:43846 (R;US)

Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center
Fuel-additive and engine-operation effects on diesel soot emissions. Information circular/1990, 15:43751 (R;US)

Bureau of Mines, Washington, DC (USA)
Minerals yearbook, 1988: Helium, 15:44493 (R;US)
Minerals yearbook, 1988: Industrial sand and gravel, 15:44483 (R;US)
Minerals yearbook, 1988: peat, 15:43774 (R;US)
Minerals yearbook, 1988: Thorium, 15:43930 (R;US)
Minerals yearbook: The mineral industry of the republic of South Africa. 1988 international review, 15:43772 (R;US)
Minerals yearbook: The mineral industry of Canada. 1988 international review, 15:43773 (R;US)
Minerals yearbook: The mineral industry of the Federal Republic of Germany. 1988 international review, 15:43775 (R;US)
Minerals yearbook: The mineral industry of Mexico. 1988 international review, 15:43834 (R;US)
Minerals yearbook: The mineral industry of Brazil. 1988 international review, 15:43776 (R;US)

Bureau of Reclamation, Denver, CO (USA)
Preliminary designer's operating criteria: McPhee power plant, Dolores Project, Colorado, 15:44109 (R;US)

Bureau of the Census, Washington, DC (USA)
Census of manufactures, 1987. Industry series: Petroleum and coal products. Industries 2911, 2951, 2952, 2992, and 2999, 15:43835 (R;US)

Burns and Roe, Inc., Oradell, NJ (USA)
Buffalo district heating system design and construction: Final report, 15:44578 (R;US)

C

California Energy Resources Conservation and Development Commission, Sacramento, CA (USA)
Quarterly oil report, third quarter 1989, 15:43810 (R;US)

California Univ., Berkeley, CA (USA). Dept. of Mechanical Engineering
Solid particle erosion in turbulent flows past tube banks, 15:43687 (R;US)

California Univ., Berkeley, CA (USA). Graduate School of Public Policy
Protecting the coastal zone through growth management: The experience of five coastal states. Technical report, 15:45480 (R;US)

California Univ., Davis, CA (USA). School of Veterinary Medicine
Laboratory for Energy-Related Health Research final annual report, fiscal year 1989, 15:45603 (R;US)

California Univ., Irvine, CA (USA)
Two-dimensional modeling of flame propagation in fuel-stream arrangements, 15:44955 (R;US)

California Univ., Los Angeles, CA (USA). Dept. of Mathematics
Algorithms to solve nonlinear time-dependent problems of engineering and physics. Final report, 1 August 1986-31 May 1989, 15:44613 (R;US)

California Univ., Santa Barbara, CA (USA)
Observation of power instability and multimode behavior in a far-infrared free-electron laser. Technical report No. 52, 1 October 1985-30 December 1986, 15:45016 (R;US)
UCSB electrostatic accelerator free-electron laser: First operation. Technical report No. 45, 1 October 1985-30 December 1985, 15:45012 (R;US)

California Univ., Santa Barbara, CA (USA). Quantum Inst.
Comment on photon antibunching in a free-electron laser. Technical report No. 49, 1 October 1985-30 December 1986, 15:45013 (R;US)
Far-infrared, low-loss, cylindrical-Gaussian eigenmodes of a bent rectangular waveguide free-electron-laser resonator. Technical report No. 41, 1 October 1984-30 September 1985, 15:45010 (R;US)
Free-electron lasers and magnetic materials. Technical report No. 53, 1 October 1984-30 September 1985, 15:45023 (R;US)
Free-electron-laser features in small-signal regime with a Gaussian mode. Technical report No. 46, 1 October 1984-30 September 1985, 15:45011 (R;US)
Incoherent emission of an electron beam in a free-electron-laser rectangular waveguide. Technical report No. 48, 1 October 1984-30 September 1985, 15:45014 (R;US)
Magnetic-tape undulators. Technical report No. 54, 1 October 1985-30 December 1986, 15:45020 (R;US)
Micro-undulator FEL technology. Technical report No. 43, 1 October 1984-30 September 1985, 15:45021 (R;US)
Photon statistical properties of an optical-wiggler free-electron laser. Technical report No. 38, 1 October 1984-30 September 1985, 15:45019 (R;US)
Quantum coherence properties of the FEL. Technical report No. 36, 1 October 1984-30 September 1985, 15:45018 (R;US)
Quantum multimode analysis of the FEL. Technical report No. 37, 1 October 1984-30 September 1985, 15:45009 (R;US)
Quantum-statistical properties of an FEL amplifier. Technical report No. 35, 1 October 1984-30 September 1985, 15:45017 (R;US)
Raman-Nath equation and classical diffusion on one-dimensional random chains. Technical report No. 47, 1 October 1984-30 September 1985, 15:45015 (R;US)
Recirculating electrostatic accelerators. Technical report No. 51, 1 October 1984-30 September 1985, 15:45082 (R;US)
Spontaneous emission in the waveguide free-electron laser. Technical report No. 59, 1 October 1985-30 December 1986, 15:45008 (R;US)
Submillimeter free-electron laser. Technical report No. 32, 1 October 1984-30 September 1985, 15:45022 (R;US)

Cambridge Univ. (UK). Dept. of Engineering
Centrifuge modeling of large ground motions and their effects on structures, 15:45657 (R;GB)
Damage mechanics of composite materials 1: Measurement of damage and strength. Technical report, 15:44807 (R;US)
Damage-based notched-strength modeling: A summary, 15:44808 (R;GB)
Experimental measurements of displacements in oil-storage tanks caused by differential settlement, 15:43848 (R;GB)

Canada
Bill C-5, an act to amend the radiation emitting devices act, 15:44022 (R;CA)
Radiation emitting devices act: Revised statutes of Canada, chapter 34 (1st. supp.), 15:44021 (R;CA)
Radiation emitting devices regulations: Consolidated Regulations of Canada 1979, Chapter 1370, 15:44028 (R;CA)
Regulations respecting the packaging and safety marking of radioactive materials preparatory to transport, 15:44020 (R;CA)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada)
A study of bacterial plugging of thief zones during oil field drilling: Final report, 15:43785 (R;CA)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Energy Research Labs.
CANMET Energy Research Laboratories annual report, 1987/88, 15:43854 (R;CA)

Canada Mortgage and Housing Corp., Ottawa, ON (Canada)
CMHC [Canada Mortgage and Housing Corp.]/EMR [Energy, Mines and Resources Canada] northern initiatives: Interim report # 3 and final report, 15:44501 (R;CA)

Canada Oil and Gas Lands Administration, Ottawa, ON (Canada)
Environmental Studies Research Funds annual report, 1989, 15:44466 (R;CA)

Canadian Committee on Electrotechnologies (Canada)
Electrotechnologies and industry: A profitable partnership: Congress 90, 15:44535 (R;CA)

Canadian Energy Research Inst., Calgary, AB (Canada)
The eighth CERI [Canadian Energy Research Institute] international oil and gas markets conference: Conference proceedings, 15:43811 (R;CA)
[The sixth annual international oil and gas markets conference], 15:43822 (R;CA)

Canadian Gas Association, Don Mills, ON (Canada). Economics/Statistics Dept.
Directory of gas distribution transmission and production companies, 1989, 15:43891 (R;CA)

Canadian Society for Chemical Engineering, Ottawa, ON (Canada)
Proceedings of 2nd international conference on separations science and technology: Vol. 2, 15:44847 (R;CA)
Proceedings of 2nd international conference on separations science and technology: Vol. 1, 15:44846 (R;CA)

Carnegie-Mellon Univ., Pittsburgh, PA (USA)
The effect of hydrogen and microstructure on the deformation and fracture behavior of a single crystal nickel-base superalloy. Final report Ph.D. Thesis, 15:44641 (R;US)

Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Computer Science
Tutorial on techniques and applications for natural language processing, 15:46276 (R;US)

Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Materials Science and Engineering
Investigation of the effects of microalloy constituents, surface treatment and oxidation conditions on the development and breakdown of protective oxide scales: Final report, 15:43688 (R;US)

Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Radiology
Electron attachment and ion mobility in hydrocarbons and related systems, 15:45606 (R;US)
Ionization in liquids: Progress report, November 1, 1987–October 31, 1990, 15:45609 (R;US)
Results of screening NCI/NTP nongenotoxic carcinogens and genotoxic noncarcinogens with the k_e test, 15:45607 (R;US)

Caterpillar, Inc., Peoria, IL (USA)
Heavy duty liquid and gaseous fuel emissions database test results from four alternative fuel configurations of the Caterpillar 3406 engine, 15:44599 (R;US)

CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Resolution enhancement for ultrasonic echographic technique in non destructive testing with an adaptive deconvolution method, 15:44990 (R;FR;In French)
Synthesis of uranium-plutonium mononitride through oxides reduction, 15:43906 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif
Investigations of actinides complexes with dibutyphosphate, 15:43910 (R;FR)
Investigations of actinides complexes for the separation chemistry, 15:43911 (R;FR)
Present status of radiochemical double beta decay study (^{238}U), 15:45983 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire
Whole-body absorbed dose rate in a worker carrying a can with contaminated liquid on his back, 15:45582 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques
A review of information on flow equations for the assessment of leaks in radioactive transport containers, 15:44963 (R;FR)
Design rules for piping: plastic stability of straight parts under level d loadings, 15:44281 (R;FR)
Linear and non-linear applications of modal analysis to seismic loadings, 15:46285 (R;FR)
Numerical evaluation of cracked pipes under dynamic loading, 15:46286 (R;FR)
RCC-MR Simplified analysis against buckling, 15:44246 (R;FR)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires
Low mass dimuon production in 200 GeV/c per nucleon sulphur ion collisions on heavy targets, 15:45943 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire
Collective flow measurements in asymmetric nuclear collisions, 15:45717 (R;FR)
One-nucleon stripping reactions induced by heavy ions at incident energies of several tens of MeV per nucleon, 15:45977 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
New method for the determination of failure and repair rates of complex systems, 15:46284 (R;FR)
Study of the electronic structure modifications of silicon oxide (α -SiO_2), aluminium oxide (α -Al_2O_3) and yttrium oxide (Y_2O_3), induced by structure defects (non-stoichiometry, mechanical stresses, heavy ion irradiation), 15:44686 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie
A parallel plate avalanche chamber for relativistic heavy ions, 15:45158 (R;FR;In French)
Study of the reaction mechanisms leading to projectile fragmentation in ^{40} Ar + Ag nat reactions at 30 MeV and 60 MeV per nucleon, 15:45718 (R;FR;In French)

Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.
Iodide volatility under condition relevant to PWR steam generator faults, 15:44224 (R;GB)
Laser vibrometer for tie bar vibration studies, 15:44991 (R;GB)
The influence of elevated temperature transformation and mechanical properties of a precipitation hardening martensitic stainless steel on its wear behaviour, 15:44618 (R;GB)
Wear scar shapes in tubes and flats - measured data and comparison with theory, 15:44282 (R;GB)

Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.
Weld simulated US Mod 9Cr1Mo steel: Pt. 2: Softening phenomenon at the base metal - heat affected zone interface, 15:44617 (R;GB)

Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)
Occupational radiation exposures at PWR type reactors: international comparison of some global indicators between 1975 and 1988, 15:45583 (R;FR;In French)
Plutonium transport for the oxide form. Air and road accidentology, 15:43921 (R;FR;In French)

Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PIRSEM)
A probabilistic and geostatistical approach of the fracture fields - Application to geothermal sites, 15:44157 (R;FR;In FR, EN)
Development of an integrated version of the SOPHOCLE generator; study of a heat pipe concentrator receiver, 15:44133 (R;FR;In French)
Geothermal historical survey of sedimentary basins, 15:44162 (R;FR;In French)
Influence of the hydrodynamical instabilities on the temperature distribution in a deep geothermal exchanger, 15:44163 (R;FR;In French)
Progress Report 1982-1985. Heliotechnology, 15:44141 (R;FR;In French)
Solar receiver producing a 100 bar - 550^{0}C steam with a cassette solar concentrator, 15:44142 (R;FR;In French)

Centre Scientifique et Technique du Batiment, 75 - Paris (France)
Measured performances of flat plate solar collector systems, 15:44144 (R;FR;In French)
Standardization of solar collectors and systems. National and international activities in CSTB in 1986, 15:44143 (R;FR;In French)

Centre Technique des Industries Aerauliques et Thermiques (CETIAT), 75 - Paris (France)
Feasability study for an aeraulic heating system, 15:44495 (R;FR;In French)
Modelization of thermodynamic cycles, 15:44496 (R;FR;In French)

Centro Brasileiro de Pesquisas Fisicas (CBPF), Rio de Janeiro, RJ (Brazil)
Moessbauer studies of ^{57}Fe substitution of Cu ions in superconducting oxides, 15:46056 (R;BR)

Centro Informazioni Studi Esperienze (CISE), Milan (Italy)
A long pulse, high energy, narrow bandwidth carbon dioxide laser for doppler wind LIDAR applications, 15:45038 (R;IT)

CER Corp., Las Vegas, NV (USA)
Staged Field Experiment No. 2: Application of advanced geological, petrophysical and engineering technologies to evaluate and improve gas recovery from low-permeability sandstone reservoirs. Travis Peak Formation, North Appleby Field, Nacogdoches County, texas. Volume 2. Topical report, 15:43863 (R;US)

Chamberlain Mfg. Corp., Niles, IL (USA). GARD Div.
Conventional research house heating characterization test results. Topical report, January-May 1989, 15:44508 (R;US)

Chicago Univ., IL (USA). Enrico Fermi Inst.
Electron microscope studies: Progress report, 1 July 1989–30 June 1990, 15:45538 (R;US)

Cincinnati Gas and Electric Co., OH (USA)
A methodology and handbook for including societal benefits in rates for cogeneration and small power production: A least cost approach, 15:44191 (R;US)

City Coll., New York, NY (USA)
Studies of central interactions of Si ions at 14.5 x A GeV/c in Au and Cu, 15:45973 (R;US)

Claflin Coll., Orangeburg, SC (USA)
Kinetics and mechanisms of the release of trace inorganic contaminants to ground water from coal ash basins on the Savannah River Site: Final report, 15:43706 (R;US)

Clarkson Univ., Potsdam, NY (USA)
Analysis and computer tools for separation process involving nonideal mixtures: Progress report, December 1, 1989–November 30, 1990, 15:44848 (R;US)

Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire
Analysis of calorimetry in ultra relativistic heavy ion collisions at 200 GeV per nucleon, 15:46014 (R;FR;In French)
Contribution to the electron density diagnostics of a plasma by means of three-wave interferometry, 15:46158 (R;FR;In French)
Experimental study of light fragment production, during the Ne + Nb reactions at 400 and 800 MeV per nucleon, applying Diogene detector, 15:45941 (R;FR;In French)
Study of the physical phenomena in the transformation of the in vivo implanted coral, using radioactivation techniques, by means of X-ray diffraction and infrared spectrometry, 15:44856 (R;FR;In French)

Coal Technology Corp., Bristol, VA (USA)
Development of an advanced, continuous mild gasification process for the production of co-products: Quarterly report, October 15, 1989–January 15, 1990, 15:43658 (R;US)

Cold Spring Harbor Lab., NY (USA)
Cold spring harbor symposia on quantitative biology: Volume 53, Molecular biology of signal transduction, 15:45520 (B;US)
Cold spring harbor symposia on quantitative biology: Volume 53, Molecular biology of signal transduction: Part 2, 15:45521 (B;US)

Colorado School of Mines, Golden, CO (USA). Dept. of Physics
Physical and electronic structure of the electrolyte-solid interface through optical phenomena: Progress report, January 1, 1989–June 30, 1990, 15:44627 (R;US)

Colorado State Univ., Fort Collins, CO (USA)
Grassland/atmosphere response to changing climate: Coupling regional and local scales: Annual progress report, 15:45335 (R;US)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina)
Galvanic corrosion evaluation of high activity nuclear waste container metals components: Final report for the period 1 December 1987 - 30 November 1989, 15:44631 (R;XA)

Commission of the European Communities, Abingdon (UK). JET Joint Undertaking
An investigation of the applicability of a JxB type current drive in tokamaks, 15:46153 (R;GB)

Commission of the European Communities, Brussels (Belgium)
Modern management in the coal-mines, 15:43728 (R;DE)

Commission of the European Communities, Ispra (Italy). Joint Research Centre
A hot-cell facility for waste management studies at the J.R.C. Ispra establishment (Italy), 15:43943 (R;IT)
An application of tracer techniques: Determination of the mass of uranium in the input solution of reprocessed Elk River fuel, 15:44012 (R;IT)

Commission of the European Communities, Luxembourg (Luxembourg)
Belgo-German experiment on underground gasification, 15:43675 (R;XE)
Community demonstration project of geothermal drilling at Saulgau, 15:44151 (R;FR;In French)
Hydrogenating extraction of coal, 15:43671 (R;XE)
Pyrolysis and gasification, 15:43679 (R;GB)
Recovery of plastics waste, 15:44575 (R;FR;In FR, EN)
The Phebus FP project, 15:44308 (R;FR)

Commission of the European Communities, Luxembourg (Luxembourg). Directorate General Telecommunications, Information Industries and Innovation
96 solar houses coupled to a seasonal heat store, in Groningen, The Netherlands: Demonstration project: Final report, 15:44149 (R;LU;In English, Dutch)
Basic studies on adhesion of anaerobic micro-organisms to inert carriers: Final report, 15:45555 (R;LU)
Belgo-German experiment on underground gasification: Demonstration project: Summarized final report, 15:43674 (R;LU)
Co-production of liquid iron and synthesis gas in smelting reduction: Demonstration project: Final report, 15:44630 (R;LU)
Coal-water slurry contribution to the European Economic Community's energy: A technical and economic study: Demonstration project, 15:43676 (R;LU)
Development of a computer package for the calculation of direct coal liquefaction process economics: Final report, 15:43677 (R;LU)
Flow in porous medium of two phases presenting a low interfacial tension: Final report, 15:43799 (R;LU)
Hydrogenating extraction of coal: Final report, 15:43670 (R;LU)
Production of ethanol or other fuel molecules by anaerobic fermentation in fixed-cell reactors of gas produced by lignocellulose gasification: Final report, 15:44088 (R;LU)
Production of hydrogen for the hydrogenation of heavy oil and coal: Demonstration project, 15:44062 (R;LU)
Retention of surfactants in porous medium: Final report, 15:43798 (R;LU)
Study of oil-water-surfactant multiphase systems: Behaviour in porous media and optimization of oil recovery: Final report, 15:43800 (R;LU)
The evaluation of cokes as filter aids in direct coal liquefaction: Final report, 15:43672 (R;LU)
The market potential of HTR [High Temperature Reactors] modular reactors as combined heat and power plants in France: Final report, 15:44200 (R;LU)
The use of a mechanical vapour recompression (energy-saving) evaporator to concentrate acid casein whey: Demonstration project: Final report, 15:44557 (R;LU)
Westfield slagging gasifier project: Demonstration project: Final report, 15:43669 (R;LU)

Computer Sciences Corp., Research Triangle Park, NC (USA)
Evaluation of the regional oxidant model (Version 2.1) using ambient and diagnostic simulations. Interim report, January 1989-April 1990, 15:45289 (R;US)

CONEG Policy Research Center, Inc., Washington, DC (USA)
Evaluation of residual stand damage following whole-tree partial cutting in northern forest types, 15:44071 (R;US)
Northeast Regional Biomass Energy Program progress report, April 1990–June 1990, 15:44065 (R;US)

Connecticut Univ., Storrs, CT (USA)
Energy transfer and non-linear optical properties at near ultraviolet wavelengths: Rare earth 4f→5d transitions in crystals and glasses: Progress report, December 1, 1989–November 30, 1990, 15:44792 (R;US)

Coordinating Research Council, Inc., Atlanta, GA (USA)
Crc low- and intermediate-temperature driveability program using gasoline- alcohol blends, 15:44594 (R;US)

Cornell Univ., Ithaca, NY (USA)
Hydrogen adsorption on the beta-N-covered W(100) surface: An infrared study of the W-H stretch, 15:44612 (R;US)
Parallel and sparse methods for large-scale numerical optimization: Progress report, 15:46295 (R;US)

Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry
Synthesis and properties of novel cluster phases: Progress report, 15:44871 (R;US)

Cornell Univ., Ithaca, NY (USA). Geotechnical Engineering Group
Manual on estimating soil properties for foundation design: Final report, 15:44370 (R;US)

Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering
Scale-up of circulating fluidized bed coal combustors: Seventh quarter technical progress report, March 1, 1990–May 31, 1990, 15:43757 (R;US)

Council of Great Lakes Governors, Chicago, IL (USA)
Great Lakes Regional Biomass Energy Program: Quarterly report, December 1, 1989–February 28, 1990, 15:44066 (R;US)
Great Lakes Regional Biomass Energy Program: Quarterly report, March 1, 1990–May 31, 1990, 15:44067 (R;US)

CRS Sirrine, Inc., Raleigh, NC (USA)
Commercial and industrial applications of adjustable-speed drives: Final report, 15:45039 (R;US)

D

David Taylor Research Center, Bethesda, MD (USA)
Propulsive efficiencies of magnetohydrodynamic submerged vehicular propulsors. Final report, 15:44523 (R;US)

David Taylor Research Center, Bethesda, MD (USA). Propulsion and Auxiliary Systems Dept.
Relationship between energy density and net power (intensity) in coupled one-dimensional dynamic systems. Final report, 15:46271 (R;US)

Decision Focus, Inc., Los Altos, CA (USA)
Evaluating hydro relicensing alternatives: Impacts on power and nonpower values of water resources: Final report, 15:44121 (R;US)

Defence Research Establishment Suffield, Ralston, AB (Canada)
Capillary-column ammonia chemical ionization GC-MS and MC-MS/MS detection of chemical warfare agents in a complex airborne matrix, 15:45212 (R;CA)
Development of the minitube air-sampling system - an automated field sampling and analysis system, 15:45233 (R;CA)
Neural-network recognition and classification of aerosol particle-size distributions. Final report, June-October 1989, 15:45234 (R;CA)
Retention index monitoring of volatile organic compounds using thermal-desorption gas chromatography, 15:45235 (R;CA)

Delaware Univ., Newark, DE (USA). Inst. of Energy Conversion
Materials analysis and device optimization of $CuInSe_2$ solar cells: Final subcontract report, 16 January 1987–15 January 1989, 15:44135 (R;US)
Two terminal $CuInSe_2$ based cascade cells: Final subcontract report, 16 January 1987–15 January 1989, 15:44139 (R;US)

Department of Energy and Forestry, Charlottetown, PE (Canada)
Prince Edward Island Energy Corporation annual report, 1988-1989, 15:44485 (R;CA)
Department of Energy, Mines and Resources, Ottawa, ON (Canada)
Energy, Mines and Resources Canada, 1990-91 estimates: Part 3. Expenditure plan, 15:44385 (R;CA)
Solar-heated garage/workshop: Final technical report on a Renewables-Conservation Demonstration Program Project, 15:44146 (R;CA)
Submersible observations off the east coast of Canada, 15:45642 (R;CA)
Department of Energy, Mines and Resources, Ottawa, ON (Canada). Renewable Energy Div.
Tidal power in Canada: A review, 15:44164 (R;CA)
Department of Energy, Mines and Resources, Vancouver, BC (Canada). Conservation and Renewable Energy Office
Small hydro Canada 87: Proceedings of the plenary sessions and technical seminars, 15:44092 (R;CA)
Department of State, Washington, DC (USA). Bureau of Oceans and International Environmental and Scientific Affairs
Puerto Rico workshop on land-based sources of marine pollution in the wider Caribbean region. Held in San Huan, Puerto Rico on August 7-9, 1989. US man and the biosphere program, 15:43842 (R;US)
Department of the Interior, Washington, DC (USA)
Gas separation with rotating plasma-arc reactor, 15:44025 (P;US)
Method and composition for controlling dust emissions, 15:43755 (P;US)
Department of the Navy, Washington, DC (USA)
Room-temperature, laser diode-pumped, Q-switched, 2 micron, thulium-doped, solid state laser, 15:45077 (P;US)
Department of Transportation, Washington, DC (USA)
National transportation strategic planning study. Staff report (Final), 15:44532 (R;US)
Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Epidemiologie und Biometric
Quantitative assessment of risks from selected carcinogenic substances in the environment, 15:45631 (R;DE;In German)
Duke Univ., Durham, NC (USA). Dept. of Chemistry
Development of infrared methods for characterization of inorganic sulfur species related to injection desulfurization processes. Final report, December 1985-June 1988, 15:43698 (R;US)
Duke Univ., Durham, NC (USA). Dept. of Medicine
Determination of the cell and mucous distribution in the airways of the lung for modeling injury due to inhaled radon and radon daughters: Progress-performance report, 15:45587 (R;US)

E

East Anglia Univ., Norwich (UK). Climatic Research Unit
Detection of CO_2-induced climatic change, 15:45245 (R;GB)
East-West Center, Honolulu, HI (USA). Energy Program
Summary of Asia-Pacific coal news, second quarter 1990, 15:43765 (R;US)
Summary of Asia-Pacific coal news, first quarter 1990, 15:43766 (R;US)
Summary of Asia-Pacific coal news, fourth quarter 1989, 15:43767 (R;US)
Trends in thermal coal trade and projections of global patterns in 2000, 15:43764 (R;US)
East-West Center, Honolulu, HI (USA). Resource Systems Inst.
The dynamics of the expanding coal supply in the Asia-Pacific region, 15:43768 (R;US)
Eastern Paving Ltd., Moncton, NB (Canada)
Recycled asphalt paving, McGivney-Astle, N.B., 15:44524 (R;CA)
Ecole Nationale Superieure des Mines, 75 - Paris (France)
Semi-empirical equation of state obtained from a perturbation theory for the representation of hydrocarbon thermodynamical properties, 15:44873 (R;FR;In French)
Theoretical and experimental study of capillary pressure hysteresis and relative permeability for natural gas underground storage, 15:43892 (R;FR;In French)
Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)
Study of morphologic and catalytic properties of cobalt base solids for synthesis of alcohols, 15:44089 (R;FR;In French)
EG and G Energy Measurements, Inc., Las Vegas, NV (USA)
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EG and G Idaho, Inc., Idaho Falls, ID (USA)
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Power Burst Facility/Boron Neutron Capture Therapy Program for Cancer Treatment: Volume 4, No. 5: Monthly bulletin, 15:45589 (R;US)
RWMC [Radioactive Waste Management Complex] vadose zone basalt characterization: FY 89 report, 15:43936 (R;US)
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Summary report for the tank tightness testing of underground storage tanks, Idaho National Engineering Laboratory, 15:44965 (R;US)
US Department of Energy Idaho Operations Office (DOE-ID) Waste Minimization Program Plan, 15:43933 (R;US)
Utilization of waste tires employing novel surface-modification technology, 15:44572 (R;US)
EG and G Idaho, Inc., Idaho Falls, ID (USA). Idaho National Engineering Lab.
Surface-crack growth: Models, experiments, and structures; Proceedings of the Symposium, Sparks, NV, Apr. 25, 1988, 15:44660 (B;US)
EG and G Mound Applied Technologies, Miamisburg, OH (USA)
Additions and revisions to the algorithms and Fortran programs to calculate quantum collision integrals for realistic intermolecular potentials, 15:45730 (R;US)
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EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant
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Electric Power Research Inst., Palo Alto, CA (USA)
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- Primer: Fracture mechanics in the nuclear power industry, 15:44284 (R;US)
- Proceedings: 1989 conference on advanced computer technology for the power industry: Volume 1, Computer technologies, 15:44198 (R;US)
- Proceedings: 1989 conference on advanced computer technology for the power industry: Volume 2, Computer technologies, 15:44199 (R;US)
- Proceedings: 1989 fuel oil utilization workshop, 15:44197 (R;US)
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- Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report, 15:44196 (R;US)
- Textile industry: Profile and DSM [demand-side management] options: Final report, 15:44474 (R;US)
- TLWorkstation™ code: Version 2.0: Volume 23: ETADS [EPRI Tower Analysis and Design System] user's manual: Final report, 15:44369 (R;US)
- Video camera use at nuclear power plants: Tools for increasing productivity and reducing radiation exposure: Final report, 15:44288 (R;US)
- Workshop proceedings: Static electrification in power transformers, 15:44194 (R;US)

Eltron Research, Inc., Aurora, IL (USA)
- Methane conversion by solid-electrolyte membranes. Annual report, January 1, 1989-December 31, 1989, 15:44490 (R;US)

ENCORE Technical Resources, Inc., Middletown, PA (USA)
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ENEA, Bologna (Italy)
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ENEA, Bologna (Italy). Dipt. Reattori Veloci
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ENEA, Casaccia (Italy). Centro Ricerche Energia
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ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base
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ENEA, Frascati (Italy). Centro Ricerche Energia
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ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base
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ENEA, Portici (Italy). Centro Ricerche Fotovoltaiche
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ENEA, Rome (Italy). Direzione Centrale Relazioni
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ENEA/Italian industry coordinated R&D in the thermo-electromechanical sector: 1983/87 program results, 15:44425 (R;IT;In Italian)

ENEA, Rome (Italy). Direzione Sicurezza Nucleare e Protezione Sanitaria
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ENEA, Saluggia (Italy). Centro Ricerche Energia
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ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile
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ENEA, Trisaia (Italy). Centro Ricerche Energia
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ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile
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Energy Systems Associates, Tustin, CA (USA)
Proceedings: 1989 fuel oil utilization workshop, 15:44197 (R;US)

Enitricerche SpA, Monterotondo (Italy)
Basic studies on adhesion of anaerobic micro-organisms to inert carriers: Final report, 15:45555 (R;LU)

Ensyn Engineering Associates, Inc., Ottawa, ON (Canada)
The conversion of gas oil in a rapid cracking process using cracking catalyst and silica sand heat carriers: Final report, 15:43809 (R;CA)

Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)
Carbon monoxide and total-hydrocarbon continuous monitoring at hazardous-waste incineration facilities, 15:45283 (R;US)
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Environment Canada, Ottawa, ON (Canada). Water Survey of Canada
Historical streamflow summary, Quebec, to 1988, 15:44096 (R;CA)
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Environmental Consultants, Inc., Southampton, PA (USA)
Advanced tree-trimming equipment: Final report, 15:44371 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA)
Light-duty automotive technology and fuel-economy trends through 1990. Technical report, 15:44533 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.
Analysis of the economic and environmental effects of compressed natural gas as a vehicle fuel. Volume 2. Heavy-duty vehicles. Special report, 15:44603 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA). Office of Mobile Sources
Analysis of the economic and environmental effects of methanol as an automotive fuel. Special report, 15:44602 (R;US)

Environmental Protection Agency, Annapolis, MD (USA). Chesapeake Bay Program
Arsenic transport and impact in Chesapeake Bay food webs. Attachment A: Arsenic impact on growth, fecundity, species composition and subsequent transport of arsenic in estuarine food webs, 15:45495 (R;US)
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Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment
Drinking-water quantification of toxicologic effects for nickel. Draft report, 15:45613 (R;US)
Rationale for assessment of risk from exposure to 2,3,7,8-TCDD, 15:45622 (R;US)

Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.
Direct/Delayed Response Project: Field operations and quality assurance report for soil sampling in the Mid-Appalachian Region of the United States, 15:45339 (R;US)

Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.
IMPROVE progress report, 15:45296 (R;US)
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Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.
Forecasts of future emissions as applied to the electric-utility industry. Report for May 1989-March 1990, 15:44210 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab.
Atmospheric sciences research in the US EPA climate program, 15:45281 (R;US)
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Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.
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Bronchial deposition of inhaled particles: Dosimetry implications for radon progeny, 15:45593 (R;US)
Ultramicro forward-mutation assay and it's application to the survey of indoor air pollution, 15:45614 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards
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Environmental Protection Agency, Seattle, WA (USA)
Coquille ocean dredged material disposal site (ODMDS) designation. Final Environmental Impact Statement, 15:45478 (R;US)
Fugitive Dust Model (FDM) (for microcomputers). Model-Simulation, 15:45318 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Cooperative Environmental Management
Leaking underground storage tank (LUST) site characteristics data base (for microcomputers). Data file, 15:45508 (R;US)
Study and analysis of leaking underground-storage-tank remediation techniques incorporated in states in EPA Region 6. Final report, 15:45471 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Drinking Water
Economic impact analysis of proposed national primary drinking water standards for 24 inorganic and synthetic organic contaminants. Final (Revised), 15:45472 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response
CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System) site location extract. Data file, 15:44394 (R;US)
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Superfund Record of Decision (EPA Region 4): Stauffer Chemical/Lemoyne, Al. (First remedial action), September 1989, 15:45470 (R;US)
Superfund Record of Decision (EPA Region 10): Silver Mountain Mine, WA. (First remedial action), March 1990. Final report, 15:45499 (R;US)
Superfund Record of Decision (EPA Region 5): Janesville Old Landfill, WI. (First remedial action), December 1989. Final report, 15:45500 (R;US)
Superfund Record of Decision (EPA Region 5): Janesville Ash Beds, WI. (First remedial action), December 1989. Final report, 15:45501 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response
Characterization of municipal solid waste in the United States: 1990 update, 15:44580 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Toxic Substances
Toxic release inventory (TRI), 1987 (for CD-ROM). Data file, 15:45507 (R;US)

Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.)
The desmoid tumour: Therapeutic results of surgical intervention as compared to those achieved with radiotherapy, 15:45552 (R;DE;In German)

Esso Resources Canada Ltd., Calgary, AB (Canada). Research Dept.
Evaluate foams to improve oil recovery from heavy oil reservoirs: Final report, 15:43797 (R;CA)

F

Failure Analysis Associates, Inc., Palo Alto, CA (USA)
Primer: Fracture mechanics in the nuclear power industry, 15:44284 (R;US)

Federal Aviation Administration, Atlantic City, NJ (USA). Technical Center
In-flight evaluations of turbine fuel extenders. Final report, 15:44600 (R;US)

Fermi National Accelerator Lab., Batavia, IL (USA)
Big-bang nucleosynthesis revisited, 15:45672 (R;US)
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Florida State Dept. of Health and Rehabilitative Services, Tallahassee, FL (USA)
Health assessment for Standard Auto Bumper Corporation, Hialeah, Dade County, Florida, Region 4. CERCLIS No. FLD004126520. Preliminary report, 15:45504 (R;US)

Florida Univ., Gainesville, FL (USA). Dept. of Nuclear Engineering Sciences
DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990, 15:44964 (R;US)

Forest Engineering Research Inst. of Canada, Pointe Claire, PQ (Canada)
Energy consumption of heavy road vehicles: Field parameter measurements and cross-impact analysis: Summary report, 15:44525 (R;CA)

Forest Service, Delaware, OH (USA). Northeastern Forest Experiment Station
Quantifying foliar responses of white ash to ozone and simulated acid precipitation: An assessment proposal for forest exposure studies. Forest Service research paper. (Final), 15:45301 (R;US)

Forsvarets Forskningsanstalt - FOA, Stockholm (Sweden)
Distribution and influence of impurities in tungsten heavy metals, 15:44643 (R;SE)

Fossil Energy Research Corp., Laguna Hills, CA (USA)
Full-scale demonstration of desulfurization by dry sodium injection: Final report, 15:44208 (R;US)

Foster-Miller, Inc., Waltham, MA (USA)
Evaluate fundamental approaches to longwall dust control: Subprogram A, Passive barriers/spray air movers for dust control: Final report, 15:43720 (R;US)
Evaluate fundamental approaches to longwall dust control: Subprogram C, Stageloader dust control: Final report, 15:43721 (R;US)
Evaluate fundamental approaches to longwall dust control: Subprogram D, Longwall automation technology: Final report, 15:43722 (R;US)
Evaluate fundamental approaches to longwall dust control: Subprogram B, Practical aspects of deep cutting: Final report, 15:43723 (R;US)
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Evaluate fundamental approaches to longwall dust control: Subprogram E, Longwall application of ventilation curtains: Final report, 15:43726 (R;US)

Frankfurt Univ. (Germany, F.R.). Fachbereich 19 - Humanmedizin
DNA hybrids suggesting a recombination process repairing radiation-induced DNA double-strand breaks in Ehrlich Ascites tumor cells, 15:45525 (R;DE;In German)

Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.)
Chances and scale of reducing emissions of air pollution by new environmental protection technologies. Final report, 15:45276 (R;DE;In German)

Fred Hutchinson Cancer Research Center, Seattle, WA (USA)
Initiation, promotion, initiation experiments with radon and cigarette smoke: Lung tumors in rats: Progress report, 15:45610 (R;US)

G

Gas Research Inst., Chicago, IL (USA)
Advanced coal gasification symposium, 15:43689 (R;US)
Fifth advanced coal gasification symposium, 15:43692 (R;US)
Second advanced coal gasification symposium, 15:43690 (R;US)
Third advanced coal gasification symposium, 15:43691 (R;US)

General Accounting Office, Washington, DC (USA). Accounting and Financial Management Div.
Environmental and energy study conference financial statements for 1988 and 1987: Financial audit, 15:44390 (R;US)
Environmental and energy study conference financial statements for 1987 and 1986: Financial audit, 15:44391 (R;US)

General Accounting Office, Washington, DC (USA). General Government Div.
Tennessee Valley Authority: Special air transportation services provided to manager of nuclear power, 15:44429 (R;US)

General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.
Fuel ethanol: Imports from Caribbean Basin initiative countries, 15:44087 (R;US)
International energy agency: Effectiveness of members' oil stocks and demand restraint measures, 15:43769 (R;US)

General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.
Air pollution EPA'S efforts to control gasoline vapors from motor vehicles, 15:43839 (R;US)
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Nuclear science: DOE's acceptance of Academy of Sciences' 1986 inertial fusion technical priorities, 15:46216 (R;US)
Nuclear waste: Quarterly report as of December 31, 1988, 15:43947 (R;US)
Nuclear waste: DOE's budgeting process for grants to Nevada needs revision, 15:43949 (R;US)
Nuclear waste quarterly report as of September 30, 1989, 15:43950 (R;US)
Nuclear waste transuranic waste storage limitations at Rocky Flats plant, 15:43951 (R;US)
Oil reserve: Status of strategic petroleum reserve activities as of September 30, 1988, 15:43770 (R;US)

Perspectives on the potential of clean coal technologies to reduce emissions from coal-fired power plants, 15:43652 (R;US)
Policy implications of funding DOE's K Reactor Cooling tower Project: Nuclear health and safety, 15:44314 (R;US)
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Surface mining: Inadequate internal controls cause procurement problems in West Virginia, 15:43709 (R;US)
Surface mining: Interior's response to abandoned mine emergencies, 15:43708 (R;US)

General Atomics, San Diego, CA (USA)
CART manual, 15:46152 (R;US)
High temperature ceramic superconductors. Quarterly progress report No. 5, 1 January-31 March 1990, 15:45024 (R;US)
rf heating in Doublet IIA, 15:46151 (R;US)

General Electric Co., San Jose, CA (USA). Nuclear Energy Div.
Foreign approaches to controlling radiation-field buildup in BWRs, 15:44327 (R;US)

General Electric Co., Schenectady, NY (USA)
Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report, 15:44196 (R;US)

General Electric Co., Schenectady, NY (USA). Corporate Research and Development Center
Development of elements of a high-Tc superconducting cable. Report for 1 January-31 March 1990, 15:45005 (R;US)

Geo-Centers, Inc., Newton Upper Falls, MA (USA)
Preparation and characterization of properties of oxynitride glasses and fibers. Final report, 15:44777 (R;US)

Geological Survey of Canada, Ottawa, ON (Canada)
Submersible observations off the east coast of Canada, 15:45642 (R;CA)

Geological Survey, Alexandria, VA (USA)
Evaluation of coal resources in the eastern part of the Fort Peck Indian Reservation, Montana, 15:43718 (R;US)
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Log-derived regional source-rock characteristics of the Woodford Shale, Anadarko Basin, Oklahoma, 15:43898 (R;US)
Mineralogical characterization of the Shelburne Marble and the Salem limestone: Test stones used to study the effects of acid rain, 15:45298 (R;US)

Geological Survey, Altamone Springs, FL (USA). Water Resources Div.
Impact of stormwater management practices on ground water. Final report, 15:45474 (R;US)

Geological Survey, Cheyenne, WY (USA). Water Resources Div.
Invertebrate communities of small streams in northeastern Wyoming. Water Resources Investigation, 15:43845 (R;US)

Geological Survey, Denver, CO (USA)
Diagenesis and uranium mineralization of the Lower Tertiary Kootznahoo Formation in the northern part of Admiralty Trough, Southeastern Alaska. Bulletin, 15:43905 (R;US)
Hydrogeologic inferences from drillers' logs and from gravity and resistivity surveys in the Amargosa Desert, southern Nevada, 15:43996 (R;US)

Geological Survey, Denver, CO (USA). Water Resources Div.
Estimation of the relative permeability distribution in fractured granitic rocks by means of vertical flow measurements in the Siblingen borehole, Switzerland. Water Resources Investigation, 15:43961 (R;US)
Geohydrology and ground-water quality at the Pueblo Depot Activity Landfill near Pueblo, Colorado. Water Resources Investigation, 15:45492 (R;US)

Geological Survey, Harrisburg, PA (USA). Water Resources Div.
Effects of acidic precipitation on the water quality of streams in the Laurel Hill Area, Somerset County, Pennsylvania, 1983-86. Water Resources Investigation, 15:45493 (R;US)

Geological Survey, Indianapolis, IN (USA). Water Resources Div.
Geohydrology, simulation of ground-water flow, and ground-water quality at two landfills, Marion County, Indiana. Water Resources Investigation, 15:45502 (R;US)

Geological Survey, Louisville, KY (USA). Water Resources Div.
Data from test drilling to trace movement of ground water in coal-bearing rocks near Fishtrap Lake in Pike County, Kentucky. Open file report (Final), 15:43719 (R;US)
Hillslope erosion at the Maxey Flats radioactive waste disposal site, northeastern Kentucky. Water Resources Investigation, 15:45341 (R;US)

Geological Survey, Nashville, TN (USA). Water Resources Div.
Hydrogeology of a hazardous-waste disposal site near Brentwood, Williamson County, Tennessee. Water Resources Investigation, 15:45491 (R;US)

Geological Survey, Raleigh, NC (USA). Water Resources Div.
Hydrogeologic, water-level, and water-quality data from monitoring wells at the US Marine Corps Air Station, Cherry Point, North Carolina. Water Resources Investigation, 15:45490 (R;US)

Geological Survey, Reston, VA (USA). Water Resources Div.
Hydrogeology and simulation of ground-water flow at Superfund-site wells G and H, Woburn, Massachusetts. Water Resources Investigation, 15:45503 (R;US)

Geological Survey, Sacramento, CA (USA). Water Resources Div.
Hydrologic and geochemical monitoring in Long Valley caldera, Mono County, California, 1986. Water Resources Investigation, 15:44156 (R;US)

Geological Survey, Salt Lake City, UT (USA). Water Resources Div.
Potential effects of anticipated coal mining on salinity of the Price, San Rafael, and Green Rivers, Utah. Water Resources Investigation, 15:43753 (R;US)

Geological Survey, Syosset, NY (USA). Water Resources Div.
Availability and historical development of ground-water resources on Long Island, New York: An introduction. Water Resources Investigation, 15:45497 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA). School of Civil Engineering
Development of a laboratory rutting-resistance testing method for asphalt mixes. Final report, January 1988-August 1989, 15:44994 (R;US)

Georgia Univ., Athens, GA (USA). Dept. of Biochemistry
Molecular biology of Lea genes of higher plants: Progress report, 15:45522 (R;US)

Geothermal Resources International, Inc., San Mateo, CA (USA)
Cascade geothermal drilling/corehole N-1: Final report, 15:44158 (R;US)

Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany, F.R.)
Aims and procedures used for the evaluation of research results in the field of nuclear safety with regard to the application of the Atomic Energy Law. Vol. 3, 15:44319 (R;DE;In German)
Data and information on foreign nuclear fuel reprocessing plants, 15:43908 (R;DE;In German)
List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: January 1 to March 31, 1990, 15:44333 (R;DE;In German)

Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany, F.R.)
GSI scientific report 1989, 15:45900 (R;DE)
Proceedings of the workshop on crystalline ion beams, 15:45081 (R;DE)

Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen (GSF), Neuherberg (Germany, F.R.). Projektraeger Umwelt- und Klimaforschung
Status report: Physico-chemical processes in the atmosphere, 15:45259 (R;DE;In German)

Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung
Investigation for determining the retention properties of rock over the ASSE II mine for dissolved radionuclides, 15:43952 (R;DE;In German)

Government-University-Industry Research Roundtable, Washington, DC (USA)
The Government-University-Industry Research Roundtable 1989 annual report, 15:44422 (R;US)

Grumman Aerospace Corp., Princeton, NJ (USA). Corporate Research Center
High beta and second stability region transport and stability analysis: Technical progress report, 15:46136 (R;US)
Gulf Canada Resources Ltd., Calgary, AB (Canada)
Impact of steam additives on the productivity of the cyclic steam stimulation process, 15:43899 (R;CA)

H

Hannover Univ. (Germany, F.R.). Fachbereich Erdwissenschaften
Investigation for determining the retention properties of rock over the ASSE II mine for dissolved radionuclides, 15:43952 (R;DE;In German)
Harry Diamond Labs., Adelphi, MD (USA)
Bioelectromagnetic effects of the electromagnetic pulse (EMP), 15:45636 (R;US)
Harvard Univ., Boston, MA (USA). School of Public Health
Asbestos exposure and gastrointestinal malignancy review and meta-analysis, 15:45623 (R;US)
Assigned shares in compensation for radiation-related cancers, 15:45592 (R;US)
Epidemiological evidence for aggravation and promotion of COPD by acid air pollution, 15:45615 (R;US)
Statistical issues in epidemiologic studies of the health effects of ambient acid aerosols, 15:45625 (R;US)
Heidelberg Univ., Mannheim (Germany, F.R.). Inst. fuer Pharmakologie und Toxikologie
Chronic effects of low ecologically relevant doses of cadmium on the immunological system of rats and mice. Animal experiments to investigate the immuno-toxicological effects of cadmium, 15:45630 (R;DE;In German)
High Energy Physics Advisory Panel (USA). Subpanel on SSC Cost Estimate Oversight
Report of the 1990 HEPAP [High Energy Physics Advisory Panel] subpanel on SSC [Superconducting Super Collider] cost estimate oversight, 15:45085 (R;US)
Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics
Application of the Ewald method to cosmological N-body simulations, 15:45682 (R;JP)
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Topological aspects of classical and quantum (2+1)-dimensional gravity, 15:46112 (R;JP)
Hochmuth (Frank W.), Brewer, ME (USA)
Steam generator with integral down-draft dryer: Project status report, April 1–June 30 1990, 15:44552 (R;US)
Holditch (S.A.) and Associates, Inc., Bryan, TX (USA)
Coal-seam Stimulation Manual. Topical report, January 1987-December 1988, 15:43862 (R;US)
Tight Gas Sands Research Program: Field operations and analysis. Post-fracture production and pressure-transient analysis of SFE No. 1. Annual report, January 1987-December 1987, 15:43864 (R;US)
Hydro-Quebec, Montreal, PQ (Canada)
Hydro-Quebec annual report, 1989, 15:44476 (R;CA)

I

ICF Resources, Inc., Fairfax, VA (USA)
An assessment of the reserve growth potential of the San Andres/Grayburg carbonate (South Central Basin Platform) play in Texas, 15:43788 (R;US)
An assessment of the reserve growth potential of the Clear Fork Platform carbonate play in Texas, 15:43789 (R;US)
Production potential of unrecovered mobile oil through infield development: Integrated geologic and engineering studies: Overview, 15:43787 (R;US)
IIT Research Inst., Chicago, IL (USA)
In-situ soil decontamination by radio-frequency heating-field test. Final report, January 1987-April 1988, 15:45334 (R;US)
Illinois Natural History Survey, Havana, IL (USA). River Research Lab.
Determination whether the causal agent for mussel die-offs in the Mississippi River is of chemical or biological origin. Final report, 15:45479 (R;US)
Illinois Univ., Chicago, IL (USA)
Control of helium accumulation, 15:46208 (R;US)
Illinois Univ., Urbana, IL (USA)
Mechanical properties of beta-silicon nitride whisker/silicon nitride matrix composites, 15:44681 (R;US)
Illinois Univ., Urbana, IL (USA). Dept. of Computer Science
An algebraic hierarchical basis preconditioner, 15:46296 (R;US)
Linear iterative solvers for implicit ODE methods, 15:46297 (R;US)
Illinois Univ., Urbana, IL (USA). Dept. of Materials Science and Engineering
Silicon carbide whisker/alumina matrix composites: Effect of whisker surface treatment on fracture toughness, 15:44682 (R;US)
Illinois Univ., Urbana, IL (USA). Fusion Studies Lab.
Alpha ash transport and ash control, 15:46137 (R;US)
Overview of advanced fuel fusion, 15:46207 (R;US)
Industry, Science and Technology Canada, Ottawa, ON (Canada)
Industry profile: Electrical wire and cable, 15:44373 (R;CA)
Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada)
Technological impact of superconductivity at liquid nitrogen temperature analysis of opportunity cases, 15:45045 (R;CA)
Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France)
Study of morphologic and catalytic properties of cobalt base solids for synthesis of alcohols, 15:44089 (R;FR;In French)
Institut National Polytechnique, 31 - Toulouse (France)
A probabilistic and geostatistical approach of the fracture fields - Application to geothermal sites, 15:44157 (R;FR;In FR, EN)
Institute of Gas Technology, Chicago, IL (USA)
Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Final report, 1988–1989, 15:43786 (R;US)
Institute of Physical Sciences in Medicine, London (UK)
Patient dosimetry techniques in diagnostic radiology, 15:46052 (R;GB)
Institution pour le Developpement de la Gazeification Souterraine, Liege (Belgium)
Belgo-German experiment on underground gasification: Demonstration project: Summarized final report, 15:43674 (R;LU)
International Atomic Energy Agency, Vienna (Austria)
Computer based aids for operator support in nuclear power plants, 15:44303 (R;XA)
Control of alpha particle transport using spatially inhomogeneous ion cyclotron resonance heating in a tokamak with general flux surface geometry: Revised, 15:46139 (R;US)
Galvanic corrosion evaluation of high activity nuclear waste container metals components: Final report for the period 1 December 1987 - 30 November 1989, 15:44631 (R;XA)
The role of advanced nuclear power technologies in developing countries: Criteria and design requirements: Proceedings of two technical committee meetings and workshops held in Vienna 27-30 June 1988 and 6-9 December 1988, 15:44263 (R;XA)
User requirements for decision support systems used for nuclear power plant accident prevention and mitigation: Report of a technical committee meeting held in Vienna, 28 November-1 December 1988, 15:44290 (R;XA)
International Centre for Theoretical Physics, Trieste (Italy)
A geometric characterization of focal manifolds of isoparametric submanifolds, 15:46101 (R;XA)
An integrality theorem for spin^c manifolds, 15:46105 (R;XA)
Astrophysical bounds on light scalar particle couplings with electron and nucleons, 15:45813 (R;XA)
Cation substitution studies in $YBa_2Cu_3O_{7-d}$ structure, 15:46081 (R;XA)

Comments on the models of a light ZKM neutrino with a large magnetic moment, 15:45812 (R;XA)
Equivalence of two dimensional gravities, 15:46099 (R;XA)
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Nonlocal Ginzburg-Landau equations. I. Pure case, 15:46082 (R;XA)
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On interior estimates of the integral moduli of continuity for derivatives of solutions of elliptic equations, 15:46103 (R;XA)
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On totally geodesic foliations of negatively curved manifolds of finite volume, 15:46100 (R;XA)
Quantum gravity in the chronometrically invariant formalism of Zel'manov, 15:45851 (R;XA)
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Relativistic dynamical reduction models: General framework and examples, 15:46104 (R;XA)
Some remarks on the minimizers of variational integrals with non-standard growth conditions, 15:46096 (R;XA)
Spinor connections and geometrization of fermion, 15:45854 (R;XA)
Strong coupling expansion in lattice QCD at finite temperature and finite baryon density, 15:45852 (R;XA)
Superconformal geometry from the Grassmann and harmonic analyticities II: The N=4SU(2) conformal case, 15:46094 (R;XA)
Weak decays of heavy mesons taking into account confinement of light quarks, 15:45815 (R;XA)

Iowa State Univ. of Science and Technology, Ames, IA (USA)
Mechanisms of coal-water mixture combustion in fluidized beds: Technical progress report, March 16, 1989–June 15, 1990, 15:43756 (R;US)

Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)
Development of a cyclic damage evaluation method: Final report, 15:44216 (R;US)

Istituto Sperimentale Modelli e Strutture SpA (ISMES), Bergamo (Italy)
ENEA activities on seismic isolation of nuclear and non-nuclear structures, 15:44328 (R;IT)

J

Japan Atomic Energy Research Inst., Tokyo (Japan)
A mathematical model for chemical reactions with actinide elements in the aqueous nitric acid solution: REACT, 15:44952 (R;JP;In Japanese)
A study on intelligent nuclear system (HASP: human acts simulation program): Progress report 1989, 15:44968 (R;JP;In Japanese)
Annual report of the Osaka Laboratory for Radiation Chemistry Japan Atomic Energy Research Institute, 21: April 1, 1987 - March 31, 1988, 15:44948 (R;JP)
Automated finder for the critical condition on the linear stability of fluid motions, 15:44981 (R;JP)
Critical heat flux experiments for high conversion light water reactor, (3): Heated length: 0.5approx1.0 m, P/D: 1.126approx1.2, number of rods: 4approx7, 15:44231 (R;JP;In Japanese)
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Developmental assessment of RELAP5/MOD3 code against ROSA-IV/TPTF horizontal two-phase flow experiments, 15:44338 (R;JP)
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Dynamic simulation analysis for nuclear ship reactor: Application to 'Mutsu' plant, 15:44254 (R;JP;In Japanese)
Effects of high temperature ECC injection on small and large break BWR LOCA simulation tests in ROSA-III program (RUNs 940 and 941), 15:44337 (R;JP)
Evaluation report on SCTF Core-III tests S3-7 and S3-8: Investigation of tie plate water temperature distribution effects on water break-through and core cooling during reflooding in PWRs with combined-injection-type ECCS, 15:44334 (R;JP)
Evaluation report on SCTF Core-III test S3-9: Investigation of CCTF coupling test results under an evaluation model condition in PWRs with cold-leg-injection-type ECCS, 15:44335 (R;JP)
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Experimental test results of multi-channel test rig of T_1 test section, 3: Test results in helium gas conditions heated to 1000 degC, 15:44241 (R;JP;In Japanese)
Experiments on tritium behavior in beryllium, (3): Development of method for measuring tritium distribution in beryllium, 15:44634 (R;JP;In Japanese)
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Present status for the determination of metallic impurities in nuclear fuels by atomic emission spectroscopy (review report), 15:44853 (R;JP;In Japanese)
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Recalculations of criticality data and subcritical limits of low-enriched homogeneous uranium fuels, 15:44278 (R;JP;In Japanese)
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The transverse stress effect on the critical current of jelly-roll multifilamentary Nb_3Al wires, 15:44632 (R;JP)

JAYCOR, Vicksburg, MS (USA)
Design concepts for hardened communications structures. Technical report, 30 January 1986-31 December 1987, 15:45213 (R;US)

Johns Hopkins Univ., Baltimore, MD (USA)
Statistically designed study of the variables and parameters of carbon dioxide equations of state, 15:43795 (R;US)
Studies of central interactions of Si ions at 14.5 x A GeV/c in Au and Cu, 15:45973 (R;US)

Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria)
Radiotracer studies of fungicide residues in food plants: Proceedings of a final research co-ordination meeting held in Ankara, 13-17 March 1989, 15:45612 (R;XA)

Joint Inst. for Nuclear Research, Dubna (USSR)
JINR rapid communications: Collection, 15:45662 (R;SU)

K

Kansas State Univ., Manhattan, KS (USA). J.R. MacDonald Lab.
The Kansas State atomic collision physics facility dedicated to the studies of atomic interactions of highly charged, low and medium energy ions, 15:45086 (R;US)

Kansas Univ., Lawrence, KS (USA). Dept. of Civil Engineering
Development of a sampling procedure for large nitrogen- and sulfur-bearing aerosols, 15:45305 (R;US)

Kantoher Co-operative Agricultural and Dairy Society Ltd., Killeedy, Ballagh (Ireland)
The use of a mechanical vapour recompression (energy-saving) evaporator to concentrate acid casein whey: Demonstration project: Final report, 15:44557 (R;LU)
Kellogg (M.W.) Co., Houston, TX (USA)
Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report, 15:44196 (R;US)
Kent State Univ., OH (USA). Dept. of Physics
Experimental constraints on binary collision cross sections in the nuclear medium, 15:45892 (R;US)
Kentucky Univ., Lexington, KY (USA). Dept. of Civil Engineering
Strength and consolidation characteristics of coal refuse for design and construction of disposal facilities: Applications of research findings. Final report, 15:43705 (R;US)
Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF)
Information system for environmental technologies, 15:45277 (R;DE;In German)
Kinetics Technology International Corp., Monrovia, CA (USA)
Study of new applications for heat pumps in the brewing industry: Phase 1: Final report, 15:44553 (R;US)
Koeln Univ. (Germany, F.R.). Medizinische Fakultaet
The value of computerized tomography and sonography in different types of pancreatitis, judged on the basis of a diagnosis previously confirmed by retrograde endoscopic cholangiopancreaticography and the pancreomycin-secretin test, 15:45551 (R;DE;In German)
Krug International, San Antonio, TX (USA). Technology Services Div.
Evaluation of the vapor-protection capabilities of the M17 respirator/hood assembly on the USAF ground-crew chemical defense ensemble. Interim report, 21 March-2 June 1988, 15:45211 (R;US)
KRW Energy Systems, Inc., Madison, PA (USA)
Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report, 15:44196 (R;US)
Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.
Proceedings of the 2nd specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor, 15:45908 (R;JP;In Japanese)
Proceedings of the specialists' meeting on radioactive wastes management, 15:43953 (R;JP;In Japanese)
Proceedings of the workshop on 'radiation protection in LINACs', 15:45135 (R;JP;In Japanese)
Proceedings of the workshop on development and application of low temperature irradiation and irradiation facilities, 15:46059 (R;JP;In Japanese)
Summary reports of activities under visiting research program in Research Reactor Institute, Kyoto University, first half of 1989, 15:46267 (R;JP;In Japanese)

L

Lawrence Berkeley Lab., CA (USA)
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Electrochemical evaluation of new fluorosulfonic and fluorophosphonic acids as fuel cell electrolytes: Final report, May 1986–December 1989: Revision, 15:44489 (R;US)
Experimental and theoretical characterization of the $YBa_2Cu_3O_7/YBa_2Cu_4O_8$ phase transformation, 15:44695 (R;US)
Fast pulsars, strange stars: An opportunity in radio astronomy, 15:45670 (R;US)
First in-beam γ-ray study of ^{67}As, 15:45953 (R;US)
Fresnel fringe effects at interfaces of thin multilayer structures, 15:46062 (R;US)
Fundamental studies of catalytic gasification: Quarterly report, January 1, 1990–March 31, 1990, 15:43686 (R;US)
Future physics with a proposed radioactive beam facility in the United States, 15:45100 (R;US)
High resolution transmission electron microscopy of aluminophosphates: Proposed structure for AlPOsub 4-8, 15:44796 (R;US)
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Hard x-ray imaging telescope: Final report, February 1, 1989–September 30, 1989, 15:45685 (R;US)
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XMM [X-ray Multi-Mirror Mission] space telescope: Development plan for the lightweight replicated x-ray gratings, 15:45686 (R;US)

Little (Arthur D.), Inc., Cambridge, MA (USA)
Development of a data base on chemical migration from polymeric materials. Project report, September 1088-September 1989, 15:45496 (R;US)

Lodestar Research Corp., Boulder, CO (USA)
Fundamental studies of fusion plasmas: Annual performance report, 15:46142 (R;US)

Los Alamos National Lab., NM (USA)
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Physics Division progress report, January 1, 1989–December 31, 1989, 15:45909 (R;US)
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Lund Univ. (Sweden). Dept. of Mathematical Physics
The high-spin structure of ^{158}Er - a theoretical study, 15:46010 (R;SE)

Lyon-1 Univ., 69 - Villeurbanne (France)
Use of additives for improvement of thermal transformation of heavy petroleum fractions, 15:43808 (R;FR;In French)

Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire
Biennial studies of nuclear physic, 15:45720 (R;FR;In FR, EN)

M

Maine Univ., Orono, ME (USA)
Intensive studies of stream fish populations in Maine. Final report, 15:45489 (R;US)

Manitoba Dept. of Energy and Mines, Winnipeg, MB (Canada)
Manitoba Energy and Mines annual report, 1988-89, 15:44386 (R;CA)

Manitoba Public Utilities Board, Winnipeg, MB (Canada)
Greater Winnipeg Gas Company and ICG Utilities (Manitoba) Ltd.: Application for a final order confirming changes in sales rates effective November 1, 1989 and January 1, 1990 pursuant to interim ex parte order no.174/89 and other related matters, 15:43887 (R;CA)
Inquiry into the indirect acquisition of the shares of ICG Utilities (Manitoba) Ltd. by Westcoast Energy Inc., 15:43871 (R;CA)

Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div.
Laboratory feasibility studies on control of tungsten contamination in Portsmouth VHE product, 15:43907 (R;US)

Maryland Dept. of Natural Resources, Annapolis, MD (USA). Chesapeake Bay Research and Monitoring Div.
Acid deposition in Maryland: Summary of results through 1989. Final report, 15:45294 (R;US)

Maryland Univ., College Park, MD (USA)
Final design and cold tests of a harmonic ubitron amplifier, 15:45003 (R;US)
Micro-fabrication compatible wiggler design scalable to submillimeter periods, 15:45002 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Chemistry
Radioactive decay and nuclear structure studies: Progress report, 15:45959 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Electrical Engineering
Nonlinear theory and design of a harmonic ubitron/free-electron laser, 15:45004 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Physics and Astronomy
Theoretical studies in nuclear reactions and nuclear structure: Progress report, 15:45999 (R;US)
Maryland Univ., College Park, MD (USA). Inst. for Advanced Computer Studies
Parallel hashing and integer sorting. Technical report, 15:46277 (R;US)
Using integrity constraints to control search in knowledge-base systems, 15:46272 (R;US)
Maryland Univ., College Park, MD (USA). Lab. for Plasma Research
High average power CW FELs [Free Electron Laser] for application to plasma heating: Designs and experiments, 15:46204 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA)
Controlled synthesis of polyenes by catalytic methods: Progress report, August 1, 1989–July 31, 1990, 15:44868 (R;US)
Critical problems in very-large-scale computer systems. Semiannual technical report, 1 October 1989-31 March 1990, 15:46278 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA). Artificial Intelligence Lab.
Parallel algorithms for computer vision. Final report, 31 August 1988-31 January 1990, 15:46282 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Electrical Engineering and Computer Science
Self-starting condition for additive-pulse mode-locked lasers, 15:44998 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science
Disconnected actions: An asynchronous extension to a nested atomic action system. Technical report, 15:46280 (R;US)
Managing parallelism and resources in scientific data-flow programs. Technical report, 15:46273 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center
Lectures in plasma diagnostics, 15:46143 (R;US)
TSC [Tokamak Simulation Code] simulations of Alcator C-MOD discharges: 3, Study of axisymmetric stability, 15:46144 (R;US)
Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics
Traps for neutral atoms. Annual report, 1 September 1988-31 August 1989, 15:45716 (R;US)
Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab.
GaInAsP/InP buried-heterostructure surface-emitting diode laser with monolithic integrated bifocal microlens, 15:45006 (R;US)
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Massachusetts Univ., Amherst, MA (USA). Dept. of Physics and Astronomy
Medium energy nuclear physics research: Progress report, October 1, 1989–June 30, 1990, 15:45897 (R;US)
Mathtech, Inc., Princeton, NJ (USA)
Economic assessment of materials damage in the South Coast Air Basin: A case study of acid-deposition effects on painted wood surfaces using individual maintenance-behavior data, 15:45287 (R;US)
MBR Environmental Corp., Culver City, CA (USA)
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Melbourne Univ., Parkville (Australia). School of Physics
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Which potentials have to be surface peaked to reproduce large angle proton scattering at high energy?, 15:46038 (R;AU)
Memorial Univ. of Newfoundland, St. John's, NF (Canada). Centre for Cold Ocean Resources Engineering
The role of C-CORE in Canadian Cold Oceans Resources Development, 15:44420 (R;CA)
Michigan Technological Univ., Houghton, MI (USA). Dept. of Physics
Development of ab-initio molecular potentials for certain alkanes. Annual report, 1 January 1989-31 December 89, 15:43896 (R;US)
Michigan Univ., Ann Arbor, MI (USA)
Basic research model of gas combustion in turbulent flow. Annual report, 1 June 1988-30 June 1989, 15:44957 (R;US)
DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990, 15:44964 (R;US)
Midwest Research Inst., Falls Church, VA (USA)
Standard test procedures for evaluating leak-detection methods: Automatic tank gauging systems. Final report, 15:43849 (R;US)
Midwest Research Inst., Kansas City, MO (USA)
Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company refuse-derived-fuel facility, Biddeford, Maine, 15:45293 (R;US)
Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 1. Summary of results. Final report, December 1987-May 1988, 15:44581 (R;US)
Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 2. Appendices A-F. Final report, December 1987-May 1988, 15:44582 (R;US)
Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 3: Appendices G-N. Final report, December 1987-May 1988, 15:44583 (R;US)
Validation of emission test method for PCDDs and PCDFs. II, 15:45306 (R;US)

Minerals and Geotechnical Logging Society (USA)
Proceedings of the third international symposium on borehole geophysics for minerals, geotechnical, and groundwater applications: Volume 1, Papers A–W, Pages 1-396, 15:45641 (R;CA)

Minerals Management Service, Herndon, VA (USA)
5-year Outer Continental Shelf oil and gas leasing program, mid-1987 to mid-1992: Supplemental environmental impact statement: Final report, 15:43841 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center
Cell performance of ultra-thin polymer-cathode cell systems. Part 2. Cation intercalating composite polymer cathode. Technical report, 1 January 1989-1 March 1990, 15:44375 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Dept. of Civil and Mineral Engineering
Minnesota transit laboratory: Phase I conclusions. Improving transit service. Final report, April 1987-December 1988, 15:44530 (R;US)

Mississippi State Univ., Mississippi State, MS (USA). Diagnostic Instrumentation and Analysis Lab.
Diagnostic development and support of MHD test facilities: Technical progress report, July, August, September 1989, 15:44487 (R;US)

Monenco Consultants Ltd., Rexdale, ON (Canada)
Utility use of variable pressure mode with two shift operation, 15:44201 (R;CA)

Montana State Univ., Bozeman, MT (USA)
Incipient oxidation of Al(111) studied using optical second harmonic generation, 15:43662 (R;US)
Oxidation of NiAl(110), 15:43661 (R;US)
Surface chemistry of model cobalt-molybdenum catalysts supported on planar γ-Al_2O_3, 15:43663 (R;US)

Motoren- und Turbinen-Union GmbH, Muenchen (Germany, F.R.)
Low pressure plasma spraying (LPPS) of coatings to give protection against corrosion by hot-gases. Final report, 15:44640 (R;DE)

Muenchen Univ. (Germany, F.R.). Medizinische Fakultaet
A radiometric method for determination of the activity of UDP-galactose-4-epimerase, 15:45524 (R;DE;In German)

N

Nagoya Univ. (Japan). Plasma Science Center
On hydrodynamics of collisionless relativistic plasma in a strong magnetic field, 15:46162 (R;JP)

Naples Univ. (Italy)
Characterization, by Rutherford backscattering spectrometry, of silicon-germanium thin films, 15:44129 (R;IT;In Italian)

NATEC, Littleton, CO (USA)
Full-scale demonstration of desulfurization by dry sodium injection: Final report, 15:44208 (R;US)

National Academy of Sciences - National Research Council, Washington, DC (USA)
Committee on DOE radiation epidemiological research programs: Annual performance report, June 1, 1989–March 31, 1990, 15:45638 (R;US)

National Aeronautical Establishment, Ottawa, ON (Canada)
Processing of advanced ceramics which have potential for use in gas-turbine aero engines. Aeronautical note, 15:44592 (R;CA)

National Aeronautics and Space Administration, Albuquerque, NM (USA). Lab. of High Energy Astrophysics
Acceleration by pulsar winds in binary systems, 15:45679 (R;US)

National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center
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National Aeronautics and Space Administration, Greenbelt, MD (USA). Lab. for High Energy Astrophysics
Neutron viscosity in accretion disks, 15:45678 (R;US)

National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center
, 15:44833 (J;US)

National Center for Atmospheric Research, Boulder, CO (USA)
Synthesis and inversion of Stokes spectral profiles. Thesis, 15:45675 (R;US)

National Energy Board, Ottawa, ON (Canada)
National Energy Board annual report, 1989, 15:44456 (R;CA)
National Energy Board, 1990-91 estimates: Part 3. Expenditure plan, 15:44455 (R;CA)

National Energy Information Center, Washington, DC (USA)
US coal production and related data, 1986-1988. Data file, 15:43777 (R;US)

National Energy Research Development and Demonstration Council, Canberra (Australia)
Coal dust explosibility on longwall faces, 15:43748 (R;AU)
Development of pillar design nomograms, 15:43750 (R;AU)
Production disruptions - Australian coal mining industry 1977-1987, 15:43771 (R;AU)
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National Geophysical Data Center, Boulder, CO (USA)
Solar-Geophysical Data Number 548, April 1990. Part 1 (prompt reports). Data for March, February 1990, and late data, 15:45676 (R;US)
Solar-Geophysical Data Number 548, April 1990. Part 2 (comprehensive reports). Data for October 1989 and miscellaneous, 15:45677 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Standards Development and Technology Transfer
NIOSH testimony on indoor air quality: Selected references before the Subcommittee on Superfund, Ocean and Water Protection, Committee on Environment and Public Works, United States Senate by J. Donald Millar, May 26, 1989, 15:45302 (R;US)

National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)
Determination of ideal-gas enthalpies of formation for key compounds: The 1988 project results, 15:44876 (R;US)
Fuels research, Volume 1: Quarterly technical report, April 1–June 30, 1990, 15:43855 (R;US)
National Institute for Petroleum and Energy Research quarterly technical report, April 1–June 30, 1990: Volume 2, Energy production research, 15:43801 (R;US)
National Institute for Petroleum and Energy Research monthly progress report for July 1990, 15:43802 (R;US)

National Inst. of Radiation Protection, Stockholm (Sweden)
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Reference instrument for radon measurements: Documentation of a radon measuring instrument based on alpha-spectrometry of electrostatically collected radon daughter elements, 15:45177 (R;SE;In Swedish)

National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)
Future prospects for studies in the VUV-SX region, 15:45129 (R;JP;In Japanese)
Status reports of supercomputing astrophysics in Japan, 15:45668 (R;JP)

National Oceanic and Atmospheric Administration, Boulder, CO (USA). Air Resources Lab.
Geophysical Monitoring for Climatic Change Number 17. Summary report, 1988, 15:45286 (R;US)

National Research Council of Canada, Ottawa, ON (Canada)
Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2, 15:44995 (R;CA)

National Research Council, Washington, DC (USA). Board on Mathematical Sciences
[Annual report of the Board on Mathematical Sciences], 15:46298 (R;US)

National Research Council, Washington, DC (USA). Committee on Alternative Energy Research and Development Strategies
Confronting climate change: Strategies for energy research and development, 15:45244 (R;US)

National Research Council, Washington, DC (USA). Transportation Research Board
Research in bus and rail transit operations, 15:44529 (R;US)
Transportation of hazardous materials 1989, 15:43924 (R;US)

National Technical Information Service, Springfield, VA (USA)
Asbestos removal. February 1972-May 1990 (A Bibliography from the NTIS data base). Report for February 1972-May 1990, 15:45509 (R;US)
Battery electrolytes. December 1982-June 1990 (A Bibliography from the NTIS data base). Report for December 1982-June 1990, 15:44376 (R;US)
Ceramic bearings. January 1988-May 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for January 1988-May 1990, 15:44698 (R;US)
Chromatography for pollution and toxicological analysis. January 1987-June 1990 (A Bibliography from the NTIS data base). Report for January 1987-June 1990, 15:45628 (R;US)
Coal tar technology. August 1973-May 1990 (A Bibliography from the NTIS data base). Report for August 1973-May 1990, 15:43695 (R;US)
Cogeneration: Economic and technical analysis. August 1983-June 1990 (A Bibliography from the NTIS data base). Report for August 1983-June 1990, 15:44567 (R;US)
Electric power load management. January 1982-June 1990 (A Bibliography from the NTIS data base). Report for January 1982-June 1990, 15:44478 (R;US)
Energy supply and demand modeling. February 1985-March 1988 (A Bibliography from the NTIS data base). Report for February 1985-March 1988, 15:44380 (R;US)
Energy supply and demand modeling. April 1988-June 1990 (A Bibliography from the NTIS data base). Report for April 1988-June 1990, 15:44381 (R;US)
Friction material patents. November 1971-May 1990 (A Bibliography from the US Patent data base). Report for November 1971-May 1990, 15:44809 (R;US)
Fusion reactor theory and conceptual design. January 1982-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1982-May 1990, 15:46226 (R;US)
Graphite lubricants. December 1976-May 1990 (A Bibliography from the COMPENDEX data base). Report for December 1976-May 1990, 15:44568 (R;US)
Health assessment: Volatile compounds in ground-water. January 1990-April 1990 (A Bibliography from the NTIS data base). Report for January 1990-April 1990, 15:45510 (R;US)
Laser window materials. January 1975-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-May 1990, 15:45049 (R;US)
Militarization of space. June 1970-June 1990 (A Bibliography from the NTIS data base). Report for June 1970-June 1990, 15:45231 (R;US)
Neodymium YAG (yttrium aluminum garnet) lasers. January 1970-June 1990 (A Bibliography from the NTIS data base). Report for January 1970-June 1990, 15:45050 (R;US)
Neodymium-iron-boron (Nd-Fe-B) permanent magnets. January 1984-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1984-May 1990, 15:44644 (R;US)
Pneumoconiosis. May 1978-March 1990 (A Bibliography from the Life Sciences Collection data base). Report for May 1978-March 1990, 15:45627 (R;US)
Radioactive pollution: Air pollution (excluding radon pollution). January 1975-May 1987 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-May 1987, 15:45319 (R;US)
Radioactive pollution: Air pollution (excluding radon pollution). June 1987-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for June 1987-June 1990, 15:45320 (R;US)
Scanning tunneling microscopy: Superconductor materials. January 1984-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1984-June 1990, 15:45204 (R;US)
Sensors and detectors based on superconducting devices. July 1982-May 1990 (A Bibliography from the EI Engineering Meetings data base). Report for July 1982-May 1990, 15:45048 (R;US)
Sensors and detectors based on superconducting devices. July 1972-July 1989 (A Bibliography from the International Aerospace Abstracts data base). Report for July 1972-July 1989, 15:45051 (R;US)
Sensors and detectors based on superconducting devices. August 1989-June 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for August 1989-June 1990, 15:45052 (R;US)
Solar cell materials: Silicon. January 1972-April 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for January 1972-April 1990, 15:44132 (R;US)
Superstring theories and models: Cosmological implications. January 1985-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1985-May 1990, 15:45873 (R;US)
Thin superconducting films: Sputtering, characterizations, and applications. January 1975-December 1987 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-December 1987, 15:46085 (R;US)
Thin superconducting films: Sputtering, characterizations, and applications. January 1988-June 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1988-June 1990, 15:46086 (R;US)
Toxicity of fibers and fiber composites. October 1988-June 1990 (A Bibliography from the NTIS data base). Report for October 1988-June 1990, 15:45629 (R;US)
Tungsten and tungsten alloy powder metallurgy. March 1986-May 1990 (A Bibliography from the COMPENDEX data base). Report for March 1986-May 1990, 15:44645 (R;US)
Waste-to-energy facilities. November 1976-May 1990 (A Bibliography from the NTIS data base). Report for November 1976-May 1990, 15:44084 (R;US)

National Toxicology Program, Research Triangle Park, NC (USA)
Toxicology and carcinogenesis studies of benzofuran (CAS No. 271-89-6) in F344/N rats and B6C3f1 mice (gavage studies). Technical report series, 15:45620 (R;US)

National Voluntary Lab. Accrediation Program, Gaithersburg, MD (USA)
NVLAP Program handbook: Personnel radiation dosimetry. Requirements for accreditation, 15:45595 (R;US)

Naval Air Rework Facility, North Island, CA (USA). Aircraft Environmental Support Office
Emissions of nitrogen oxides from the testing of F404-400 engines at Naval Air Station, Lemoore, California, 15:45237 (R;US)
Gaseous emissions from aircraft engines. A handbook for the calculation of emission indexes and gaseous emissions from aircraft engines, 15:45238 (R;US)
Oxides of nitrogen emissions from the testing of Tf41-A-2B engines at Naval Air Station, Lemoore, California, 15:45236 (R;US)

Naval Ocean Systems Center, San Diego, CA (USA)
Linear algebra on a Cray X-MP. Technical document, 15:46281 (R;US)

Naval Research Lab., Washington, DC (USA)
EINMUF: An h-f MUF, FOT, LUF prediction program. Final report, March-December 1989, 15:45708 (R;US)
Field evaluation of a passive sampling device for hydrazines in ambient air. Memorandum report, 15:45239 (R;US)
Relativistic klystron amplifiers driven by modulated intense relativistic electron beams. Memorandum report, 15:45000 (R;US)
Stability regimes in a helical quadrupole focusing accelerator - theory and simulation. Memorandum report, 15:45083 (R;US)
X-ray-Laser Program report for FY 1989. Final report, 1 October 1988-30 September 1989, 15:45025 (R;US)

Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.
Silver-bearing, high-temperature, superconducting (HTS) paint, 15:44779 (R;US)

Nebraska Univ., Lincoln, NE (USA). Dept. of Physics
Theory of RBE: Seventh triennial report, January 1, 1967–December 31, 1990, 15:45586 (R;US)

New Jersey Dept. of Environmental Protection, Trenton, NJ (USA)
Health assessment for Upper Deerfield Township Sanitary Landfill, Upper Deerfield Township, Cumberland County, New Jersey, Region 2. CERCLIS No. NJD980761399. Final report, 15:45506 (R;US)

New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (USA)
Continental magmatism abstracts: Bulletin 131, 15:45640 (R;US)

New Mexico Inst. of Mining and Technology, Socorro, NM (USA)
Laboratory investigation of residual liquid organics from spills, leaks, and the disposal of hazardous wastes in ground water. Final report, April 1986-August 1989, 15:45498 (R;US)

New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center
Improvement of CO_2 flood performance: Fifth annual report for the period October 1, 1988–September 30, 1989, 15:43796 (R;US)

New Mexico State Univ., Las Cruces, NM (USA)
Flow and transport at the Las Cruces trench site: Experiments 1 and 2, 15:45468 (R;US)

New York Univ. Medical Center, NY (USA). Microbiology Dept.
Anaerobic O-demethylation of phenylmethylethers: Progress report, 15:44076 (R;US)

New York Univ., NY (USA). Courant Inst. of Mathematical Sciences
Control of alpha particle transport using spatially inhomogeneous ion cyclotron resonance heating in a tokamak with general flux surface geometry: Revised, 15:46139 (R;US)

New Zealand Energy Research and Development Committee, Auckland (New Zealand)
Assessment of the industrial potential of west coast coal, 15:43697 (R;NZ)
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Niels Bohr Inst., Copenhagen (Denmark)
External field dependence in SU(2) lattice theory, 15:45871 (R;DK)
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Nolan, Davis and Associates Ltd., St. John's, NF (Canada)
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Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)
Dependencies, human interactions and uncertainties in probabilistic safety assessment, 15:44218 (R;SE)

North Carolina Dept. of Natural Resources and Community Development, Raleigh, NC (USA). Div. of Land Resources
Geology of the Southeast Durham and Southwest Durham 7.5-minute Quadrangles, North Carolina, 15:45656 (R;US)

North Carolina State Univ., Raleigh, NC (USA)
Canopy reflectance of soybean as affected by chronic doses of ozone in open-top field chambers, 15:45300 (R;US)

Northern Pipeline Agency, Ottawa, ON (Canada)
Northern Pipeline Agency Canada, 1990-91 estimates: Part 3. Expenditure plan, 15:43888 (R;CA)

Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering
Chemical tests for nutrient and trace-element availability in coal-cleaning wastes: Development of methods based on routine soil tests. Final report, 29 September 1980-28 February 1982, 15:43699 (R;US)

Notre Dame Univ., IN (USA). Radiation Lab.
Radiation Laboratory, University of Notre Dame quarterly report, April 1–June 30, 1990, 15:44947 (R;US)

NSI Technologies, Inc., Tulsa, OK (USA)
Stress test and hydraulic-fracture analysis in the Frontier Formation. Texaco State of Wyoming U-NCT-1-No. 1, Bruff Field, Sweetwater County, Wyoming. Topical report, March 1990, 15:43860 (R;US)

Nuclear Energy Agency, 75 - Paris (France)
Nuclear Energy in Perspective, 15:44007 (R;XN)
Occupational dose control in Nuclear Power Plants: An Overview, 15:46051 (R;XN)
Probabilistic safety assessment in nuclear power plant management, 15:44214 (R;XN)
Projected costs of generating electricity from power stations for commissioning in the period 1995-2000, 15:44277 (R;XN)

Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan)
Effect of different gamma sterilizing doses on the fertility and progeny production of pulse beetle (callosobruchus maculatus), 15:45575 (R;PK)
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Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering
Aging evaluation of class 1E batteries: Seismic testing, 15:44342 (R;US)
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Initial assessment of the mechanisms and significance of low-temperature embrittlement of cast stainless steels in LWR systems, 15:44219 (R;US)
Value/impact assessment of jet impingement loads and pipe-to-pipe impact damage: Revised methods and criteria, 15:44344 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
Nuclear Regulatory Commission issuances, June 1990: Volume 31, No. 6, 15:44257 (R;US)
Title list of documents made publicly available, June 1–30, 1990: Volume 12, No. 6, 15:44256 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Licensee Performance and Quality Evaluation
Historical data summary of the systematic assessment of licensee performance: Revision 6, 15:44258 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Inspection and Safeguards
Licensee contractor and vendor inspection status report: Quarterly report, January 1990–March 1990, 15:44255 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
An assessment of BWR [boiling water reactor] Mark-II containment challenges, failure modes, and potential improvements in performance, 15:44343 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
A demonstration experiment of steam-driven, high-pressure melt ejection: The HIPS-10S Test, 15:44341 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data
Backfitting guidelines, 15:44259 (R;US)
Report to Congress on abnormal occurrences, January–March 1990: Volume 13, No. 1, 15:44340 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
Assessment of RELAP5/MOD2, Cycle 36.04 against LOFT small break experiment L3-6, 15:44345 (R;US)
Assuring the availability of funds for decommissioning nuclear reactors, 15:44260 (R;US)

O

Oak Ridge Gaseous Diffusion Plant, TN (USA)
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Bonneville Power Administration Communication Alarm Processor expert system: Design and implementation, 15:44365 (R;US)
Building Thermal Envelope Systems and Materials (BTESM) and research utilization/technology transfer progress report for DOE Office of Buildings and Community Systems: Monthly progress report, June 1990, 15:44507 (R;US)
Coherent particle production from relativistic heavy-ion collisions, 15:45781 (R;US)
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DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990, 15:44964 (R;US)
Energy Division annual progress report for period ending September 30, 1989, 15:44426 (R;US)
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[Complementary applications of diffraction by neutrons and x-ray synchrotron radiation]: Foreign trip report, July 16, 1990–August 3, 1990, 15:46065 (R;US)
[Developing tools for performance visualization of parallel algorithms]: Foreign trip report, July 28, 1990–August 5, 1990, 15:46309 (R;US)
[Eighteenth international conference on phenomena in ionized gases]: Foreign trip report, July 11, 1987–August 2, 1987, 15:45731 (R;US)
[Emergency planning for technological and natural hazards]: Foreign trip report, July 3, 1990–July 14, 1990, 15:45639 (R;US)
[Feasibility study of the San Lorenzo River hydroelectric project]: Foreign trip report, July 8–14, 1990, 15:44101 (R;US)
[Neutron dosimetry]: Foreign trip report, October 10–17, 1987, 15:45171 (R;US)
[Plasma facing components and blanket/first wall engineering]: Foreign trip report, July 2, 1990–July 28, 1990, 15:46223 (R;US)
[Pre-equilibrium nuclear reactions and methods for the calculation of fast neutron nuclear data]: Foreign trip report, February 7, 1988–February 20, 1988, 15:46222 (R;US)
[Research activities in actinide chemistry and small angle scattering research]: Foreign trip report, July 28, 1990–August 11, 1990, 15:44855 (R;US)
[Robots, systems, and flexible automation]: Foreign trip report, July 2, 1990–July 21, 1990, 15:44969 (R;US)
[Sparsity in large scale scientific computation]: Foreign trip report, August 3, 1990–August 11, 1990, 15:46310 (R;US)
[Standards for properties of steam]: Foreign trip report, September 11, 1987–September 20, 1987, 15:44203 (R;US)
[Superconductivity and information exchange]: Foreign trip report, June 24, 1990–July 24, 1990, 15:46084 (R;US)
[The 1990 ACM international conference on supercomputing]: Foreign trip report, June 9, 1990–June 29, 1990, 15:46308 (R;US)
[X-ray and synchrotron source investigations]: Foreign trip report, July 18, 1990–August 3, 1990, 15:44642 (R;US)

Oak Ridge National Lab., TN (USA). Applied Technology Div.
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Oak Ridge Y-12 Plant, TN (USA)
An inside look at temperature measurement solutions from a casting facility, 15:45229 (R;US)

Office of Naval Research Liaison Office, Far East, APO San Francisco, CA 96503 (USA)
ONR Far East Scientific Information Bulletin, Volume 13, No. 4, 15:44805 (R;US)

Office of Radiation Programs, Washington, DC (USA)
EPA workshop on radioactivity-contaminated sites. Held in Albuquerque, New Mexico on May 3-5, 1989, 15:45340 (R;US)

Office of Surface Mining Reclamation and Enforcement, Washington, DC (USA)
Alluvial valley floor guidelines, 1980. Final report, 15:43711 (R;US)
Coal mining and reclamation operations. Part 1. The determination of the probable hydrologic consequences. Part 2. The statement of the results of test borings or core samplings. Handbook, 15:43752 (R;US)

Office of the Deputy Under Secretary of Defense for Policy, Washington, DC (USA)
Security of nuclear reactors and special nuclear materials. Directive, 15:44346 (R;US)

Office of the Secretary of Defense, Washington, DC (USA)
Department of Defense methodology guidelines for High Power Microwave (HPM) susceptibility assessments: Draft, 15:45219 (R;US)

Office of the Under Secretary of Defense (Acquisition), Washington, DC (USA)
Militarily critical technologies list. Volume 1. List of militarily critical technologies, 15:45215 (R;US)

Ohio Public Utilities Commission, Columbus, OH (USA)
A methodology and handbook for including societal benefits in rates for cogeneration and small power production: A least cost approach, 15:44191 (R;US)

Ohio Univ., Athens, OH (USA)
Study of structure of nuclei with neutrons and nuclear data measurements for MFE: Progress report, December 1, 1987–July 31, 1990, 15:46206 (R;US)

Oklahoma Univ., Norman, OK (USA). School of Electrical Engineering and Computer Science
Multi-area power system reliability and production costing: Final report, 15:44574 (R;US)

Ontario Hydro Research Div., Toronto, ON (Canada)
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Ontario Hydro, Toronto, ON (Canada)
Review of the environmental assessment for the flue gas desulphurization (FGD) program, 15:44457 (R;CA)

Ontario Ministry of Energy, Toronto, ON (Canada)
Cogeneration: Experience and prospects in Ontario: Proceedings of the seminar, 15:44560 (R;CA)

Oregon Graduate Center, Beaverton, OR (USA). Dept. of Chemical and Biological Sciences
Bioconversion technology at the Oregon Graduate Center: Annual report, 2nd year, 15:44075 (R;US)

Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA)
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Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA). Dept. of Environmental Science and Engineering
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Pacific-Sierra Research Corp., Arlington, VA (USA). Washington Operations
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Pakistan Inst. of Nuclear Science and Technology, Islamabad (Pakistan). Radiation and Isotope Application Div.
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Pennsylvania State Univ., University Park, PA (USA). Dept. of Materials Science and Engineering
Advanced processing and properties of high-performance alloys. Technical report No. 16, 1 January-31 December 1989, 15:44614 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Dept. of Nuclear Engineering
1-D RFP [Reversed Field Pinch] plasma simulations with interchange turbulence driven transport, 15:46141 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Environmental Resources Research Inst.
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Long-term removal and retention of iron and manganese from acidic mine drainage by wetlands. Volume 2. Tarutis thesis. Final report, July 1987-January 1990, 15:43704 (R;US)

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Petroleum Recovery Inst., Calgary, AB (Canada)
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Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle
Product control of radioactive waste. Proceedings, 15:43970 (R;DE;In German)

Pisa Univ. (Italy)
Foreign-gas pressure broadening and shift of ammonia transition lines in the nu_2 vibrational bands, 15:44850 (R;IT)

Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
Solid superacids as coal liquefaction catalysts: Quarterly report, April 15, 1990–June 15, 1990, 15:43660 (R;US)
Studies of dense phase cohesive coal transport in plugs: Final technical report, September 1986–May 1990, 15:43727 (R;US)

Poitiers Univ., 86 (France)
Solar receiver producing a 100 bar - 550^{0}C steam with a cassette solar concentrator, 15:44142 (R;FR;In French)

Polytechnic of the South Bank, London (UK). Inst. of Environmental Engineering
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Powerex Corp., Inc., Youngwood, PA (USA)
Development of gate turnoff thyristors: Final report, 15:44195 (R;US)

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Princeton Univ., NJ (USA). Plasma Physics Lab.
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Public Service Electric and Gas Co., Newark, NJ (USA)
Workshop proceedings: Static electrification in power transformers, 15:44194 (R;US)

Purdue Univ., Lafayette, IN (USA). Dept. of Agronomy
Evaluation of potential herbaceous biomass crops on marginal crop lands: 1, Agronomic potential: Final report, 1985–1989, 15:44072 (R;US)

Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering
Basic studies of 3-V high efficiency cell components: Annual subcontract report, August 15, 1988–August 14, 1989, 15:44136 (R;US)

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Radex, Inc., Bedford, MA (USA)
Evaluation of magnetospheric internal-magnetic-field models and existing software. Report No. 3, June 1989-January 1990, 15:45711 (R;US)
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Radian Corp., Austin, TX (USA)
Full-scale demonstration of desulfurization by dry sodium injection: Final report, 15:44208 (R;US)

Radian Corp., Research Triangle Park, NC (USA)
Locating and estimating air-toxics emissions from sewage-sludge incinerators. Final report, March-November 1989, 15:45290 (R;US)
Pulverized-coal combustion: Pollutant formation and control, 1970-1980. Final report, 15:43758 (R;US)

Radian Corp., Sacramento, CA (USA)
Installation-restoration program. Stage 3. McClellan Air Force Base. Quality-Assurance Project Plan. Final report, November 1987-May 1990, 15:45462 (R;US)

Radiation Effects Research Foundation, Hiroshima (Japan)
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Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry
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Research and Productivity Council, NB (Canada)
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Resource Dynamics Corp., Vienna, VA (USA)
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Resource Enterprises, Inc., Salt Lake City, UT (USA)
Western Cretaceous Coal Seam Project. Final project summary. Final topical report, 1 January 1988-31 August 1989 (research), 15:43858 (R;US)
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Western Cretaceous Coal Seam Project. Evaluation of the cooperative research well, Colorado 32-7 Number 9. Operated by Mobil Oil Corporation. Topical report, January 1988-December 1989, 15:43861 (R;US)

Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)
Operation Touchstone: Onsite radiological safety report for announced nuclear tests, October 1987 through September 1988, 15:45228 (R;US)

Rice Univ., Houston, TX (USA)
Studies of central interactions of Si ions at 14.5 x A GeV/c in Au and Cu, 15:45973 (R;US)

Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy
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Riley Stoker Corp., Worcester, MA (USA). Riley Research Center
Development of an advanced mild gasification process: Final report, 15:43659 (R;US)

Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA)
High-expansion foam for LNG vapor mitigation. Topical report, September 1987-December 1989, 15:43882 (R;US)
LNG vapor mitigation by doubling tank-wall integrity. Topical report, September 1987-March 1989, 15:43893 (R;US)
Reduction of LNG operator error and equipment failure rates. Topical report, 20 April 1990, 15:43867 (R;US)

Risoe National Lab., Roskilde (Denmark). Agriculture Dept.
Agricultural research department. Annual report 1989, 15:46268 (R;DK;In Danish)

Risoe National Lab., Roskilde (Denmark). Electronics Dept.
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Risoe National Lab., Roskilde (Denmark). Physics Dept.
A fast-acting hydrogen gas source for staged pneumatic high-speed acceleration of fusion plasma fuel pellets, 15:46239 (R;DK)

Rochester Univ., NY (USA)
Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1989–November 30, 1990, 15:44869 (R;US)

Rochester Univ., NY (USA). Dept. of Chemistry
Intermolecular potential functions from spectroscopic properties of weakly bound complexes: First progress report, July 1, 1989–June 30, 1990, 15:44872 (R;US)

Rochester Univ., NY (USA). Dept. of Computer Science
Debugging and analysis of large-scale parallel programs. Doctoral thesis, 15:46279 (R;US)
Programming environment for parallel-vision algorithms. Final technical report, February 1988-December 1989, 15:46275 (R;US)

Rochester Univ., NY (USA). Dept. of Physics and Astronomy
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Rochester Univ., NY (USA). Lab. for Laser Energetics
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Rural Electrification Administration, Washington, DC (USA)
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Rutgers–the State Univ., New Brunswick, NJ (USA). Lab. for Computer Science Research
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[Natural fragmentation of exploding cylinders], 15:45218 (R;US)

Saskatchewan Dept. of Energy and Mines, Regina, SK (Canada)
Solar-heated garage/workshop: Final technical report on a Renewables-Conservation Demonstration Program Project, 15:44146 (R;CA)

Science Applications International Corp., Greenwood Village, CO (USA)
Soviet measurements of strategic balance and arms control. Sanitized. Technical report, 1 April 1984-30 September 1985, 15:44604 (R;US)

Science Research Lab., Inc., Somerville, MA (USA)
New discharge pumping method for CO_2 lasers. Report for 1 February-30 November 1989, 15:44997 (R;US)

Serageldin (Mohamed A.), Winston-Salem, NC (USA)
Soot formation: A review (edition with figures and tables), 15:44956 (R;US)

Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)
Monthly results of measurements, November 1989, 15:45325 (R;FR;In French)

Sheridan Technical Associates, Inc., Oakville, ON (Canada)
Evaluation of heavy oil recovery process using a novel combination of injectants: Final report, 15:43804 (R;CA)

Siemens AG Unternehmensbereich KWU, Karlstein (Germany, F.R.)
Long-term leaching of spent fuel in rock salt and quinary brine and the influence of iron on mobilization of elements. Final report, 15:43954 (R;DE;In German)

Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory
An astrophysics data program investigation of cluster evolution. Semiannual report No. 1, 1 August 1989-31 January 1990, 15:45674 (R;US)

Solar Energy Research Inst., Golden, CO (USA)
Basic studies of 3-V high efficiency cell components: Annual subcontract report, August 15, 1988–August 14, 1989, 15:44136 (R;US)
Comparison of wind tunnel airfoil performance data with wind turbine blade data, 15:44168 (R;US)
Evaluation criteria and test methods for electrochromic windows, 15:44515 (R;US)
High efficiency $CuInSe_2$ and $CuInGaSe_2$ cells and materials research: Final subcontract report, 1 November 1987–31 October 1989, 15:44138 (R;US)
Ion-assisted doping of 2-6 compounds during physical vapor deposition: Final subcontract report, September 1, 1985–August 30, 1989, 15:44137 (R;US)
Materials analysis and device optimization of $CuInSe_2$ solar cells: Final subcontract report, 16 January 1987–15 January 1989, 15:44135 (R;US)
Two terminal $CuInSe_2$ based cascade cells: Final subcontract report, 16 January 1987–15 January 1989, 15:44139 (R;US)

Southern Co. Services, Inc., Birmingham, AL (USA)
Southern Company Services' study of a Kellogg Rust Westinghouse (KRW)-based gasification-combined-cycle (GCC) power plant: Final report, 15:44196 (R;US)

Southern Methodist Univ., Dallas, TX (USA). Dept. of Geological Sciences
Equipment to support the development of high-resolution geophysical site-characterization procedures. Final report, 15 December 1988-14 December 1989, 15:45230 (R;US)

Southwest Research Inst., San Antonio, TX (USA)
Variability of I/M test scores over time, 15:45304 (R;US)

Spire Corp., Bedford, MA (USA)
Self-lubricating-diamond like coatings deposition. Final report, 20 November 1986-28 March 1989, 15:44683 (R;US)

SRI International, Menlo Park, CA (USA)
Investigation of mechanisms of environmentally accelerated crack growth in reactor pressure vessel steels: Final report, 15:44225 (R;US)

Stanford Linear Accelerator Center, Menlo Park, CA (USA)
Data flow integration for geodetic applications, 15:46333 (R;US)
Discrete gravity, 15:45876 (R;US)
Discretized light-cone quantization: Application to quantum electrodynamics, 15:45875 (R;US)
Properties of hadronic decays of the Z boson, 15:45804 (R;US)
Searches for new quarks and leptons in Z boson decays, 15:45805 (R;US)

Stanford Univ., CA (USA). Dept. of Materials Science and Engineering
Ion-assisted doping of 2-6 compounds during physical vapor deposition: Final subcontract report, September 1, 1985–August 30, 1989, 15:44137 (R;US)

Stanford Univ., CA (USA). Petroleum Research Inst.
A study on Newton related nonlinear methods in well test analysis, production schedule optimization and reservoir simulation, 15:43790 (R;US)
Effect of metallic additives on in situ combustion of Huntington Beach crude experiments, 15:43794 (R;US)
SUPRI heavy oil research program thirteenth annual report, October 1, 1988–September 30, 1989, 15:43792 (R;US)
The accurate measurement of heat flux using thin film heat flux sensors with application to petroleum engineering, 15:43791 (R;US)
Theoretical development of flow into a well through perforations, 15:43793 (R;US)

Stanford Univ., CA (USA). School of Medicine
Methods for analyzing occupational cohort data with application to lung cancer in US uranium miners: Techniques for fitting and checking exposure-time-response models, 15:45594 (R;US)

Stanford Univ., CA (USA). Systems Optimization Lab.
Pseudo-monotone complementarity problems in Hilbert space, 15:46321 (R;US)

State Univ. of New York, Binghamton, NY (USA)
Photochemistry of intermolecular C-H bond activation reactions: Progress report, 15:44938 (R;US)

State Univ. of New York, Buffalo, NY (USA). Dept. of Electrical and Computer Engineering
Soft x-ray contact imaging of biological specimens using a laser-produced plasma as an x-ray source: Final report, 15:45556 (R;US)

State Univ. of New York, Stony Brook, NY (USA). Dept. of Earth and Space Sciences
Regional seismic event location with a sparse network: Application to eastern Kazakhstan, USSR, 15:44608 (R;US)

Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)
Inorganic coatings on stainless steel for protection against crevice corrosion, 15:44655 (R;SE;In Swedish)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
Optimization of the GaAs et GaAs/Si annealing using halogen lamp flashes, 15:44790 (R;FR;In French)
Study and construction of a high frequency power preamplifier applying thick film hybrid technology, 15:45031 (R;FR;In French)
Study of the correlations between intermediate mass fragments in the $^{86}Kr + ^{197}Au$ reaction at 43 MeV/nucleon, 15:45976 (R;FR;In French)
VME data acquisition system. Interactive software for the acquisition, display and storage of one or two dimensional spectra, 15:46292 (R;FR;In French)

Studsvik Nuclear, Nykoeping (Sweden)
Examination of reaction products on the surface of UO_2 fuel exposed to reactor coolant water during power operation, 15:44221 (R;SE)
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Failure development in leaking LWR fuel rods - a literature survey, 15:44223 (R;SE)
Investigation of fuel behaviour at different power levels: Final report, 15:44222 (R;SE)

Sverdrup Technology, Inc., Haslet, TX (USA)
TLWorkstation™ code: Version 2.0: Volume 23: ETADS [EPRI Tower Analysis and Design System] user's manual: Final report, 15:44369 (R;US)

Swedish Council for Building Research, Stockholm (Sweden)
North sun '88 proceedings: Solar energy at high latitudes, 15:44127 (R;SE)

Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden)
^{14}C-analyses of calcite coatings in open fractures from the Klipperaas study site, Southern Sweden, 15:43994 (R;SE)

Examination of reaction products on the surface of UO_2 fuel exposed to reactor coolant water during power operation, 15:44221 (R;SE)
Examination of the surface deposit on an irradiated PWR fuel specimen subjected to corrosion in deionized water, 15:44236 (R;SE)
FARF31 - a far field radionuclide migration code for use with the PROPER package, 15:45348 (R;SE)

Swedish Nuclear Power Inspectorate, Stockholm (Sweden)
Assessment of RELAP5/MOD2, Cycle 36.04 against LOFT small break experiment L3-6, 15:44345 (R;US)

Systems Applications, Inc., San Rafael, CA (USA)
Development of CBM-X mechanisms for urban and regional aqsms. Final report, July 1982-October 1985, 15:45278 (R;US)
Urban Airshed Model study of five cities. Volume 2. Demonstration of low-cost application of the model to the city of Atlanta and the Dallas-Fort Worth Metroplex region, 15:45311 (R;US)
Urban Airshed Model study of five cities. Volume 3. Evaluation of base case model performance for the cities of St. Louis and Philadelphia using rich and sparse meteorological inputs, 15:45312 (R;US)
Urban Airshed Model study of five cities. Volume 4. Low-cost application of the model to Atlanta and evaluation of the effects of biogenic emissions on emission-control strategies, 15:45313 (R;US)
Urban Airshed Model study of five cities. Volume 5. A low-cost application of the urban airshed model to the New York Metropolitan Area and the City of St. Louis, 15:45314 (R;US)
Urban Airshed Model study of five cities. Volume 6. Low-cost application of the model to future-year SIP control and alternative-fuel strategies for Dallas-Fort Worth, Atlanta, Philadelphia and St. Louis. (Volume 1: results), 15:45315 (R;US)
Urban Airshed Model study of five cities. Volume 7. Low-cost application of the model to future-year SIP control and alternative-fuel strategies for Dallas-Fort Worth, Atlanta, Philadelphia, and St. Louis, 15:45316 (R;US)

T

Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.)
Organization of radiation protection in German nuclear power stations, 15:44318 (R;DE;In German)

Tellus Inst., Inc., Boston, MA (USA)
Energy implications of alternative solid waste management systems: Final report, 15:44571 (R;US)

Tenera Corp., Berkeley, CA (USA)
Primer: Fracture mechanics in the nuclear power industry, 15:44284 (R;US)

Tennessee Technological Univ., Cookeville, TN (USA). Tennessee Cooperative Fishery Research Unit
Benthic macroinvertebrates of low-order streams of coal surface-mining areas of the Cumberland Plateau, Kentucky, Tennessee, and Alabama. Volume 1. Final report, 15:43710 (R;US)

Tennessee Univ., Knoxville, TN (USA)
DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990, 15:44964 (R;US)

Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry
Development of a fiber-optic based instrument for on-line Raman analysis of process chemical composition, 15:45187 (R;US)

Tennessee Univ., Tullahoma, TN (USA). Space Inst.
An economic analysis of the optimum stoichiometry for an early commercial MHD [magnetohydrodynamics] steam combined cycle power plant, 15:44192 (R;US)
Priority pollutants in solid phase combustion products from the Department of Energy's MHD [magnetohydrodynamics] Coal-Fired Flow Facility: Final report, 15:44486 (R;US)

Terra Tek, Inc., Salt Lake City, UT (USA)
Spalling and the development of a hydraulic-fracturing strategy for coal. Semiannual report, April-September 1990, 15:43754 (R;US)

Texas A and M Univ., College Station, TX (USA). Research Foundation
Properties of CO_2 mixtures with N_2 and with CH_4. Topical report, June 1988, 15:43895 (R;US)

Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst.
Development of standard transit profiles for Texas. Technical report (Final), September 1988-November 1989, 15:44528 (R;US)
Development of standard transit profiles for Texas. Final technical report, September 1988-November 1989, 15:44531 (R;US)

Texas Univ., Austin, TX (USA)
DOE/NE robotics for advanced reactors: Bimonthly progress report, June–July 1990, 15:44964 (R;US)

Texas Univ., Austin, TX (USA). Bureau of Economic Geology
An assessment of the reserve growth potential of the San Andres/Grayburg carbonate (South Central Basin Platform) play in Texas, 15:43788 (R;US)
An assessment of the reserve growth potential of the Clear Fork Platform carbonate play in Texas, 15:43789 (R;US)
Geology of the Lower Cretaceous Travis Peak Formation, East Texas. Depositional history, diagenesis, structure, and reservoir-engineering implications. Topical report, November 1982-February 1990, 15:43857 (R;US)
Production potential of unrecovered mobile oil through infield development: Integrated geologic and engineering studies: Overview, 15:43787 (R;US)

Texas Univ., Austin, TX (USA). Center for Energy Studies
Calendar year 1985-87 solar and weather data for Austin, Texas. Research report, 15:45292 (R;US)
Independent critical assessment of fuel sources for Fayette Power Project Unit Number 3, 15:44204 (R;US)

Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study
A quantitative measurement of the oxygen amount in Si target, 15:44852 (R;JP;In Japanese)
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Quantum distribution function of nonequilibrium system, 15:45855 (R;JP)

Topical Testing, Inc., Salt Lake City, UT (USA)
Biological model of the effects of toxic substances. Final report, 1 July 1989-1 January 1990, 15:45605 (R;US)

TRC Environmental Consultants, Inc., Mountainlake Terrace, WA (USA)
Fugitive Dust Model (FDM) user's guide (revised). Volume 1. User's instructions. Final report, 15:45280 (R;US)

TSI Trintek Systems (Ontario), Inc., Concord, ON (Canada)
Environmental assessment documents for energy from waste facility, 440 Commissioners St., Toronto, Ontario, 15:44206 (R;CA)

Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet
The effects of human thyropexin (hTBG) and human prealbumin (hTBPA) on the thyroxine metabolism in the rabbit, 15:45547 (R;DE;In German)
The use of computerized tomography in patients showing tardive dyskinesia, 15:45553 (R;DE;In German)

Tunnelling Association of Canada (Canada)
Proceedings of the international congress on progress and innovation in tunnelling: Volumes 1 and 2, 15:44995 (R;CA)

U

UKAEA Culham Lab., Abingdon (UK)
Parameters of a reference tokamak reactor, 15:46202 (R;GB)

UKAEA Dounreay Nuclear Power Development Establishment (UK)
Natural convection cooling of liquid metal systems: A review, 15:44247 (R;GB)

UKAEA Harwell Lab. (UK). Chemistry Div.
Heat capacity of protactinium metal and three plutonium compounds at low temperatures: Final report, 15:44615 (R;GB)

UKAEA Harwell Lab. (UK). Environmental and Medical Science Div.
Clusters of health effects associated with radiation around the world (excluding the UK), 15:45581 (R;GB)

UKAEA Harwell Lab. (UK). EURATOM/UKAEA Association
A study of the environmental impact of fusion, 15:46200 (R;GB)

UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.
U.K. nuclear data progress report: January - December 1988, 15:46036 (R;GB)

UKAEA Northern Research Labs., Risley (UK)
Nuclear power stations in August: information and commentary, 15:44348 (R;GB)

UKAEA Northern Research Labs., Springfields (UK)
The MERLIN programme: Pt. 9: Post test examination of MERLIN Bundle B, 15:44233 (R;GB)

UKAEA Safety and Reliability Directorate, Culcheth (UK)
Radioactive waste disposal by UKAEA establishments during 1987 and associated environmental monitoring results, 15:43995 (R;GB)
The medical implications of nuclear power plant accidents, 15:44357 (R;GB)
The role of high temperature heterogeneous reaction kinetics in the rate of radionuclide vaporisation during core-concrete interactions, 15:44356 (R;GB)

Ulm Univ. (Germany, F.R.). Fakultaet fuer Klinische Medizin
CT examination after intrathecal or intraventricular application of metrizamide in 110 patients for neurosurgery., 15:45550 (R;DE;In German)

Umweltbundesamt, Berlin (Germany, F.R.)
Chronic effects of low ecologically relevant doses of cadmium on the immunological system of rats and mice. Animal experiments to investigate the immuno-toxicological effects of cadmium, 15:45630 (R;DE;In German)
Quantitative assessment of risks from selected carcinogenic substances in the environment, 15:45631 (R;DE;In German)

United Nations Industrial Development Organization, Vienna (Austria)
Biotechnology-based development. Opportunities and issues in technology transfer and commercialization, 15:45528 (R;XU)
Strengthening of the essential oil industry in Korea. Technical report: Design of modern chemical equipment for the production and processing of essential oils, 15:44078 (R;XU)

United Technologies Corp., East Hartford, CT (USA). Research Center
Investigation of laser diagnostics of PACVD [Plasma Assisted Chemical Vapor Deposition] processes for depositing hard face coatings: Performance report for the period 1 September 1989–31 May 1990, 15:44791 (R;US)

United Technologies Research Center, East Hartford, CT (USA)
Interfacial studies of chemical-vapor-infiltrated (CVI) ceramic matrix composites. Final report, 15:44684 (R;US)

University of Southern California, Los Angeles, CA (USA). Loker Hydrocarbon Research Inst.
Composite materials with improved properties in compression. Appendix 1. Cyclopropanation of poly(1-methyl-1-phenyl-1-sila-cis-pent-3-ene). Synthesis and characterization of poly(1-methyl-3,4-methylene-1-phenyl-1-sila-cis-pent-3-ene). Interim report, 15:44778 (R;US)
Composite materials with improved properties in compression. Appendix 5. Synthesis and anionic ring-opening polymerization of 1-germa-1,1-dimethyl(3,4,c)thienocyclopentane. Interim report, 15:44780 (R;US)
Composite materials with improved properties in compression. Appendix 2. Anionic ring opening polymerization of 1-silacyclopent-3-ene. Characterization of poly(1-sila-cis-pent-3-ene) by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy. Interim report, 15:44781 (R;US)
Composite materials with improved properties in compression. Appendix 4. Addition of difluorocarbene to poly(1-methyl-1-phenyl-1-sila-cis-pent-3-ene). Characterization of microstructures by ^{1}H, ^{13}C, and ^{19}F and ^{29}Si NMR. Interim report, 15:44782 (R;US)
Composite materials with improved properties in compression. Anionic ring opening polymerization of 2-methyl-2-silaindan. Characterization of the polymer and mechanism of polymerization, 15:44783 (R;US)
Composite materials with improved properties in compression: Copolymerization of 1,1-dimethyl-1-silacyclopent-3-ene and 1,1-diphenyl-1-silacyclopent-3-ene. Characterization of copolymer microstructures by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy, 15:44784 (R;US)
Composite materials with improved properties in compression: Anionic polymerization of 1-methyl-1-silacyclopent-3-ene. Characterization of poly(1-methyl-1-sila-cis-pent-3-ene) by ^{1}H, ^{13}C, and ^{29}Si NMR spectroscopy and mechanism of polymerization, 15:44785 (R;US)

University of Wyoming Research Corp., Laramie, WY (USA). Western Research Inst.
Development of an advanced mild gasification process: Final report, 15:43659 (R;US)

Uppsala Univ., Nykoeping (Sweden). Studsvik Neutron Research Lab.
Delayed-neutron branching ratios of fission products: A status report, 15:45955 (R;SE)
On the use of the cold time-of-flight spectrometer in Studsvik for liquid ^{3}He measurements, 15:45170 (R;SE)

USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC (USA)
US Department of Energy technical safety appraisal reference manual: Volume 1, 15:44387 (R;US)
US Department of Energy technical safety appraisal reference manual: Volume 2, 15:44388 (R;US)

USDOE Assistant Secretary for International Affairs and Energy Emergencies, Washington, DC (USA). Office of the Deputy Assistant Secretary for Energy Emergencies
Staff report: Electric power supply and demand for the contiguous United States, 1989–1998, 15:44472 (R;US)

USDOE Assistant Secretary for Policy, Planning and Analysis, Washington, DC (USA). Office of Policy Integration
Impacts on home heating costs of incentives for alternative fuels vehicles, 15:44601 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels
Electric power monthly, May 1990, 15:44471 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
Energy consumption by end-use sector: A comparison of measures by consumption and supply surveys, 15:44449 (R;US)
International petroleum statistics report, July 1990, 15:43832 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
International oil and gas exploration and development activities: Quarterly report, fourth quarter 1989, 15:43784 (R;US)
Petroleum marketing monthly, May 1990, 15:43831 (R;US)
Petroleum supply annual 1989: Volume 2, 15:43830 (R;US)

USDOE Environmental Measurements Lab., New York, NY (USA)
^{222}Rn, ^{222}Rn progeny and ^{220}Rn progeny as atmospheric tracers of air masses at the Mauno Loa Observatory, 15:45248 (R;US)
1989 Intercomparison of radon progeny measurement methods and equipment in North America, 15:45250 (R;US)
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The August 1988 and June 1989 radon intercomparisons at EML [Environmental Measurements Laboratory], 15:45251 (R;US)

USDOE Idaho Operations Office, Idaho Falls, ID (USA). Task Force
Environmental Restoration and Waste Management site specific plan for DOE-ID: Overview, 15:43932 (R;US)

USDOE Nevada Operations Office, Las Vegas, NV (USA). Yucca Mountain Project Office
Yucca Mountain Project technical status report (TSR), October 1989–March 1990, 15:43960 (R;US)

USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)
OCRWM Systems Engineering Management Plan (SEMP): Revision 1, 15:43935 (R;US)

USDOE Office of Energy Research, Washington, DC (USA)
FEDIX: An on-line information service for universities and other research organizations: User's guide: Version 3.0, Release 1.0, 15:46326 (R;US)
USDOE Office of Environmental Restoration and Waste Management, Washington, DC (USA)
Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1989: Report to Congress in response to Public Law 99-240, 15:43929 (R;US)
USDOE Office of Procurement and Assistance Management, Washington, DC (USA)
Department of Energy annual procurement and financial assistance report, FY 1989, 15:46266 (R;US)
USDOE Richland Operations Office, WA (USA)
Low-level burial grounds dangerous waste permit application: Request for exemption from lined trench requirements for submarine reactor compartments, 15:43934 (R;US)
USDOE, Washington, DC (USA)
Environmental restoration and waste management: Five year plan, fiscal years 1992–1996: Executive summary, 15:44005 (R;US)
Utah Univ., Salt Lake City, UT (USA). Dept. of Chemical Engineering
Investigation of rate processes in the thermal treatment of contaminated soils. Final report, November 1986-November 1989, 15:45342 (R;US)

V

VEBA-Oel AG, Gelsenkirchen (Germany, F.R.)
Production of hydrogen for the hydrogenation of heavy oil and coal: Demonstration project, 15:44062 (R;LU)
Vermont Univ., Burlington, VT (USA). Genetics Lab.
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Virginia Commonwealth Univ., Richmond, VA (USA)
[Compensation for peak shifts and variable background responses in fluorescence spectroscopy]: Progress report, February 1, 1988–August 1, 1990, 15:44849 (R;US)
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA)
Molecular biology of one-carbon metabolism in anaerobic bacteria. Annual report, January 1989-December 1989, 15:44079 (R;US)
Perennial species for optimum production of herbaceous biomass in the Piedmont: Final report, 1985–89, 15:44069 (R;US)
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Center for Environmental and Hazardous Material Studies
Processing hazardous materials: Risk information at the local level. Final report on Phase 1, 15:45621 (R;US)
Voltaix, Inc., North Branch, NJ (USA)
Experimental evaluation of the synthetic solid-electrolyte interface (SSEI) concept for the primary Ca-$SOCl_2$ battery system. Final report, 15 April-15 October 1988, 15:44374 (R;US)
Vrije Univ., Amsterdam (Netherlands). Inst. voor Milieuvraagstukken
The macroeconomic impacts of the EC large combustion plants directive proposal, 15:43702 (R;XE)

W

Washington Univ., Seattle, WA (USA)
^{89}Zr chelates for antibody labelling: Annual report, July 15, 1989–July 14, 1990, 15:45549 (R;US)
Adiabatic invariance and transient resonance in very slowly varying oscillatory Hamiltonian systems, 15:46091 (R;US)
Computing environments, interactive graphics and nonparametric methods for data analysis: Progress report 1988–89 and Research plan 1989–90, 15:46293 (R;US)
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Experiments on linear high beta helical axis stellarators to study simulated toroidal effects and Alfven-wave heating: Progress report No. 4, July 16, 1989–November 15, 1989, 15:46140 (R;US)
The mathematical analysis of bursting electrical activity in pancreatic beta cells, 15:45523 (R;US)
Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program
"Compact toroid research": Technical progress report, August 1988–August 1989, 15:46209 (R;US)
Washington Univ., Seattle, WA (USA). Dept. of Physics
Parity nonconservation and nuclear polarizabilities, 15:46003 (R;US)
Washington Univ., Seattle, WA (USA). Nuclear Physics Lab.
[Experimental nuclear physics]: Annual report 1990, 15:45898 (R;US)
Wessel (E.T.), Murrysville, PA (USA)
Primer: Fracture mechanics in the nuclear power industry, 15:44284 (R;US)
Western Ontario Univ., London, ON (Canada). Faculty of Engineering and Science
Application of the pseudoadiabatic reactor to the conversion of synthesis gas into blending stocks: Final report, 15:44090 (R;CA)
Western Research Inst., Laramie, WY (USA)
Characterization of leachate from abandoned coal refuse. Final report, 15:43712 (R;US)
Westinghouse Hanford Co., Richland, WA (USA)
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Weston (Roy F.), Inc., Walnut Creek, CA (USA)
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Wisconsin Univ., Madison, WI (USA). Engine Research Center
Effects of auxiliary injection on diesel-engine combustion, 15:44591 (R;US)
Wisconsin Univ., Milwaukee, WI (USA). Dept. of Physics
Surface-wave characterization of high-Tc superconductors. Final report, 30 September 1984-30 September 1989, 15:46079 (R;US)
Woods Hole Oceanographic Institution, MA (USA)
Diffusion of helium isotopes in silicate glasses and minerals: Implications for petrogenesis and geochronology. Doctoral thesis, 15:45659 (R;US)

Z

Zenon Environmental, Inc., Burlington, ON (Canada)
Investigation of the use of porous membranes for the treatment of crude oil emulsions: Final report, 15:43903 (R;CA)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

Aamodt, R.E., Fundamental studies of fusion plasmas: Annual performance report, 15:46142 (R;US)

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Photon statistical properties of an optical-wiggler free-electron laser. Technical report No. 38, 1 October 1984-30 September 1985, 15:45019 (R;US)
Quantum coherence properties of the FEL. Technical report No. 36, 1 October 1984-30 September 1985, 15:45018 (R;US)
Quantum multimode analysis of the FEL. Technical report No. 37, 1 October 1984-30 September 1985, 15:45009 (R;US)
Quantum-statistical properties of an FEL amplifier. Technical report No. 35, 1 October 1984-30 September 1985, 15:45017 (R;US)

Raman-Nath equation and classical diffusion on one-dimensional random chains. Technical report No. 47, 1 October 1984-30 September 1985, 15:45015 (R;US)
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Incoherent emission of an electron beam in a free-electron-laser rectangular waveguide. Technical report No. 48, 1 October 1984-30 September 1985, 15:45014 (R;US)
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Recirculating electrostatic accelerators. Technical report No. 51, 1 October 1984-30 September 1985, 15:45082 (R;US)
Submillimeter free-electron laser. Technical report No. 32, 1 October 1984-30 September 1985, 15:45022 (F;US)
UCSB electrostatic accelerator free-electron laser: First operation. Technical report No. 45, 1 October 1985-30 December 1985, 15:45012 (R;US)
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μ-Oxo-bis(oxo) dinuclear complexes of technetium(V) with amine phenol ligands: Syntheses, characterization, and x-ray crystal structures, 15:44924 (J;US)

Ab initio multireference configuration interaction study of CH_2NNO_2. HONO elimination vs NN bond fragmentation, 15:44922 (J;US)

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AMMONIA
Development and selection of ammonia emission factors for the 1985 NAPAP emissions inventory. Final report, August 1987-December 1989, 15:45303 (R;US)

Foreign-gas pressure broadening and shift of ammonia transition lines in the nu_2 vibrational bands, 15:44850 (R;IT)

AMPHETAMINES
Radiohalogenated amphetamine analogs for blood flow and serotonin receptor studies, 15:45915 (BA;US)

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Final design and cold tests of a harmonic ubitron amplifier, 15:45003 (R;US)

Relativistic klystron amplifiers driven by modulated intense relativistic electron beams. Memorandum report, 15:45000 (R;US)

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DNA hybrids suggesting a recombination process repairing radiation-induced DNA double-strand breaks In Ehrlich Ascites tumor cells, 15:45525 (R;DE;In German)

Determination of the cell and mucous distribution in the airways of the lung for modeling injury due to inhaled radon and radon daughters: Progress-performance report, 15:45587 (R;US)

Mechanisms of induction of specific chromosomal alterations, 15:45585 (R;US)

The mathematical analysis of bursting electrical activity in pancreatic beta cells, 15:45523 (R;US)

ANIMAL TISSUES
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A radiometric method for determination of the activity of UDP-galactose-4-epimerase, 15:45524 (R;DE;In German)

Power Burst Facility/Boron Neutron Capture Therapy Program for Cancer Treatment: Volume 4, No. 5: Monthly bulletin, 15:45589 (R;US)

Power Burst Facility/Boron Neutron Capture Therapy Program for Cancer Treatment: Volume 4, No. 4: Monthly bulletin, 15:45588 (R;US)

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State of the art address oncogenes and tumor-suppressing genes, 15:45541 (R;US)

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Rewiew of recent measurements on neutral pion photoproduction near threshold experimental features, 15:45729 (RA;FR)

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ICEMANd: Microwave detection of ultra-high energy neutrinos in ice, 15:45696 (J;US)

Low-frequency measurements of the CMB spectrum, 15:45694 (J;US)

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ANTI-SATELLITE SYSTEMS
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ANTIBODIES
^{89}Zr chelates for antibody labelling: Annual report, July 15, 1989–July 14, 1990, 15:45549 (R;US)

Nuclear Medicine Program progress report for quarter ending June 30, 1990, 15:45554 (R;US)

ANTIFERROMAGNETIC MATERIALS
Magnetic particles induced by plasma disruptions in tokamaks, 15:46215 (R;IT)

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Nonlinear sigma model and quantum antiferromagnets, 15:45868 (RA;JP)

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Antimatter, strangeness and exotic objects at RHIC [relativistic heavy ion collider], 15:45778 (R;US)

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Benthic macroinvertebrates of low-order streams of coal surface-mining areas of the Cumberland Plateau, Kentucky, Tennessee, and Alabama. Volume 1. Final report, 15:43710 (R;US)

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AQUIFERS
Adsorption of chromate/organic-acid waste mixtures in aquifer materials: Technical progress report, July 1, 1989–June 30, 1990, 15:45464 (R;US)

Impact of stormwater management practices on ground water. Final report, 15:45474 (R;US)

Proceedings of the third international symposium on borehole geophysics for minerals, geotechnical, and groundwater applications: Volume 1, Papers A–W, Pages 1-396, 15:45641 (R;CA)

ARAB REPUBLIC OF EGYPT
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High energy γ rays following the $^{92}Mo + ^{40}Ar$ reaction, 15:45968 (RA;JP;In Japanese)
Study of the reaction mechanisms leading to projectile fragmentation in ^{40} Ar + Ag nat reactions at 30 MeV and 60 MeV per nucleon, 15:45718 (R;FR;In French)

ARMS CONTROL
Assessment of the utility of on-site inspection for INF treaty verification. Sanitized. Technical report, 15:44607 (R;US)
Disarmament: The role of conventional arms control in national security strategy. Final report, 15:44605 (R;US)
Rock strength under confined shock conditions, 15:44610 (R;US)

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In-situ soil decontamination by radio-frequency heating-field test. Final report, January 1987-April 1988, 15:45334 (R;US)
Preparation and characterization of $(C_5Me_5)Rh(CNR)_2$ and $[(C_5Me_5)Rh(CNR)]_2$ complexes, 15:44909 (J;US)
Solid-state chemistry of molecular metal oxide clusters. Bis(triphenylphosphine)rhodium(I) carbonyl derivatives, 15:44914 (J;US)

ARRAY PROCESSORS
Architectures for optical computing. Final report, 1 September 1986-31 January 1990, 15:46274 (R;US)
Linear algebra on a Cray X-MP. Technical document, 15:46281 (R;US)

ARSENIC
Arsenic transport and impact in Chesapeake Bay food webs. Attachment A: Arsenic impact on growth, fecundity, species composition and subsequent transport of arsenic in estuarine food webs, 15:45495 (R;US)
Crystal Chemical Company, arsenic exposure study, Houston, Texas, Region 6. Final report, 15:45618 (R;US)

ARSENIC 67
First in-beam γ-ray study of ^{67}As, 15:45953 (R;US)

ASBESTOS
Asbestos exposure and gastrointestinal malignancy review and meta-analysis, 15:45623 (R;US)
Asbestos removal. February 1972-May 1990 (A Bibliography from the NTIS data base). Report for February 1972-May 1990, 15:45509 (R;US)
Health assessment for Ambler Asbestos Piles, Ambler, Pennsylvania, Region 3 (addendum to). CERCLIS No. OAD000436436. Final report, 15:45617 (R;US)
Pneumoconiosis. May 1978-March 1990 (A Bibliography from the Life Sciences Collection data base). Report for May 1978-March 1990, 15:45627 (R;US)
Toxicity of fibers and fiber composites. October 1988-June 1990 (A Bibliography from the NTIS data base). Report for October 1988-June 1990, 15:45629 (R;US)

ASHES
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Kinetics and mechanisms of the release of trace inorganic contaminants to ground water from coal ash basins on the Savannah River Site: Final report, 15:43706 (R;US)
Strength and consolidation characteristics of coal refuse for design and construction of disposal facilities: Applications of research findings. Final report, 15:43705 (R;US)

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ASPHALTS
Development of a laboratory rutting-resistance testing method for asphalt mixes. Final report, January 1988-August 1989, 15:44994 (R;US)
Recycled asphalt paving, McGivney-Astle, N.B., 15:44524 (R;CA)

ASSE SALT MINE
Investigation for determining the retention properties of rock over the ASSE II mine for dissolved radionuclides, 15:43952 (R;DE;In German)

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Status reports of supercomputing astrophysics in Japan, 15:45668 (R;JP)

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Recent results on cleaning and conditioning the ATF vacuum system, 15:46255 (J;US)

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Urban Airshed Model study of five cities. Volume 2. Demonstration of low-cost application of the model to the city of Atlanta and the Dallas-Fort Worth Metroplex region, 15:45311 (R;US)
Urban Airshed Model study of five cities. Volume 6. Low-cost application of the model to future-year SIP control and alternative-fuel strategies for Dallas-Fort Worth, Atlanta, Philadelphia and St. Louis. (Volume 1: results), 15:45315 (R;US)

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Status report: Physico-chemical processes in the atmosphere, 15:45259 (R;DE;In German)
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Summary of Asia-Pacific coal news, second quarter 1990, 15:43765 (R;US)
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Light-duty automotive technology and fuel-economy trends through 1990. Technical report, 15:44533 (R;US)
Light-duty vehicle summary: First six months of model year 1990, 15:44527 (R;US)
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In-flight evaluations of turbine fuel extenders. Final report, 15:44600 (R;US)
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Weak decays of heavy mesons taking into account confinement of light quarks, 15:45815 (R;XA)
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Environmental monitoring for EG and G Idaho facilities at the Idaho National Engineering Laboratory: Annual report, 1989, 15:45247 (R;US)
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Fundamental studies of catalytic gasification: Quarterly report, January 1, 1990--March 31, 1990, 15:43686 (R;US)
Moessbauer studies of ^{57}Fe substitution of Cu ions in superconducting oxides, 15:46056 (R;BR)
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Electronic structure of the gold/$Bi_2Sr_2CaCu_2O_8$ and gold/$EuBa_2Cu_3O_{7-\delta}$ interfaces as studied by photoemission spectroscopy, 15:44763 (J;US)
Experimental and theoretical characterization of the $YBa_2Cu_3O_7/YBa_2Cu_4O_8$ phase transformation, 15:44695 (R;US)
Fabrication of microwave guides using high-Tc superconductors. Final report, 15 July 1989-14 January 1990, 15:45007 (R;US)
First principles calculation of oxygen ordering in $YBa_2Cu_3O_{7-y}$, 15:44702 (R;US)
Lead based $Pb(B_1B_2)O_3$ relaxors vs $BaTiO_3$ dielectrics for multilayer capacitors, 15:44708 (BA;US)
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Observations and implications of grain boundary dislocation networks in high-angle $YBa_2Cu_3O_{7-\delta}$ grain boundaries, 15:44767 (J;US)
Oxygen ordered superstructures and domain formation in $YBa_2Cu_3O_{7-x}$, 15:44697 (R;US)
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Specific heat of $YBa_2Cu_3O_7$: Origin of the "linear" term and volume fraction of superconductivity, 15:44764 (J;US)
The application of Rutherford backscattering and channeling techniques to the characterization of ceramics, 15:44715 (BA;US)
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Collective models in excited nuclei and excited baryons, 15:46000 (RA;US)

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Diffusion of helium isotopes in silicate glasses and minerals: Implications for petrogenesis and geochronology. Doctoral thesis, 15:45659 (R;US)
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Some estimation concerning crossing transition of the main injector, 15:45117 (R;US)
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Ceramic bearings. January 1988-May 1990 (A Bibliography from the International Aerospace Abstracts data base). Report for January 1988-May 1990, 15:44698 (R;US)
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Health assessment for addendum to Cliff/Dow Dump, Marquette County, Michigan. CERCLIS No. MID980679666, 15:45475 (R;US)
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Evaluation of potential herbaceous biomass crops on marginal crop lands: 1, Agronomic potential: Final report, 1985–1989, 15:44072 (R;US)
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Great Lakes Regional Biomass Energy Program: Quarterly report, December 1, 1989–February 28, 1990, 15:44066 (R;US)
Great Lakes Regional Biomass Energy Program: Quarterly report, March 1, 1990–May 31, 1990, 15:44067 (R;US)
Guidelines for forest biomass inventory, 15:44070 (R;CA)
Manipulation of wood chemical traits for energy: An assessment, 15:44082 (R;US)
Northeast Regional Biomass Energy Program progress report, April 1990–June 1990, 15:44065 (R;US)
Selection and improvement of herbaceous energy crops for the southeastern USA: Final report on a field and laboratory research program for the period March 15, 1985 to March 14, 1990, 15:44068 (R;US)

BIOMASS PLANTATIONS
Evaluation of potential herbaceous biomass crops on marginal crop lands: 1, Agronomic potential: Final report, 1985–1989, 15:44072 (R;US)
Perennial species for optimum production of herbaceous biomass in the Piedmont: Final report, 1985–89, 15:44069 (R;US)

BIOMEDICAL RADIOGRAPHY
Patient dosimetry techniques in diagnostic radiology, 15:46052 (R;GB)
Quantitative analysis for radiation image measured by bioimage analyzer, 15:45164 (R;JP;In Japanese)

BIOTECHNOLOGY
Bioconversion technology at the Oregon Graduate Center: Annual report, 2nd year, 15:44075 (R;US)
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Cogeneration: Economic and technical analysis. August 1983-June 1990 (A Bibliography from the NTIS data base). Report for August 1983-June 1990, 15:44567 (R;US)
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Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 3: Appendices G-N. Final report, December 1987-May 1988, 15:44583 (R;US)
Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 1. Summary of results. Final report, December 1987-May 1988, 15:44581 (R;US)
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Comment on photon antibunching in a free-electron laser. Technical report No. 49, 1 October 1985-30 December 1986, 15:45013 (R;US)
Recirculating electrostatic accelerators. Technical report No. 51, 1 October 1984-30 September 1985, 15:45082 (R;US)

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Far-infrared, low-loss, cylindrical-Gaussian eigenmodes of a bent rectangular waveguide free-electron-laser resonator. Technical report No. 41, 1 October 1984-30 September 1985, 15:45010 (R;US)

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Quantum coherence properties of the FEL. Technical report No. 36, 1 October 1984-30 September 1985, 15:45018 (R;US)

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Submillimeter free-electron laser. Technical report No. 32, 1 October 1984-30 September 1985, 15:45022 (R;US)
UCSB electrostatic accelerator free-electron laser: First operation. Technical report No. 45, 1 October 1985-30 December 1985, 15:45012 (R;US)

Emission
Spontaneous emission in the waveguide free-electron laser. Technical report No. 59, 1 October 1985-30 December 1986, 15:45008 (R;US)

Far Infrared Radiation
Observation of power instability and multimode behavior in a far-infrared free-electron laser. Technical report No. 52, 1 October 1985-30 December 1986, 15:45016 (R;US)
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Quantum coherence properties of the FEL. Technical report No. 36, 1 October 1984-30 September 1985, 15:45018 (R;US)
Quantum multimode analysis of the FEL. Technical report No. 37, 1 October 1984-30 September 1985, 15:45009 (R;US)
Quantum-statistical properties of an FEL amplifier. Technical report No. 35, 1 October 1984-30 September 1985, 15:45017 (R;US)
Raman-Nath equation and classical diffusion on one-dimensional random chains. Technical report No. 47, 1 October 1984-30 September 1985, 15:45015 (R;US)

Signals
The 3-D FEL pulse propagation equation: An analytical treatment in the low gain and small signal regime, 15:45040 (R;IT)

Stability
Observation of power instability and multimode behavior in a far-infrared free-electron laser. Technical report No. 52, 1 October 1985-30 December 1986, 15:45016 (R;US)

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Free-electron lasers and magnetic materials. Technical report No. 53, 1 October 1984-30 September 1985, 15:45023 (R;US)
Magnetic-tape undulators. Technical report No. 54, 1 October 1985-30 December 1986, 15:45020 (R;US)
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Long-term removal and retention of iron and manganese from acidic mine drainage by wetlands. Volume 1. Methods, results, and appendices. Final report, July 1987-January 1990, 15:43703 (R;US)
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Neodymium-iron-boron (Nd-Fe-B) permanent magnets. January 1984-May 1990 (A Bibliography from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1984-May 1990, 15:44644 (R;US)
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Radiation emitting devices act: Revised statutes of Canada, chapter 34 (1st. supp.), 15:44021 (R;CA)
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Municipal-waste-combustion multipollutant study, emission test report. Maine Energy Recovery Company, refuse-derived-fuel facility, Biddeford, Maine. Volume 2. Appendices A-F. Final report, December 1987-May 1988, 15:44582 (R;US)
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Health assessment: Volatile compounds in ground-water. January 1990-April 1990 (A Bibliography from the NTIS data base). Report for January 1990-April 1990, 15:45510 (R;US)
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Health assessment for American Crossarm and Conduit, Chehalis, Lewis County, Washington, Region 10. CERCLIS No. WAD057311094. Preliminary report, 15:45484 (R;US)
Health assessment for Cimarron Mining Corporation, Carrizozo, Lincoln County, New Mexico, Region 6. CERCLIS No. NMD980749378. Preliminary report, 15:45485 (R;US)
Health assessment for General Electric (Spokane Shop), Spokane, Washington, Region 10. CERCLIS No. WAD001865450. Preliminary report, 15:45505 (R;US)
Health assessment for Missouri Electric Works (MEW) Proposed National Priorities List Site, Cape Girardeau, Missouri, Region 7. CERCLIS No. MOD980965982. Preliminary report, 15:45482 (R;US)
Health assessment for New Hanover County Burn Pit, Wilmington, New Hanover County, North Carolina, Region 4. CERCLIS No. NCD981021157. Preliminary report, 15:43843 (R;US)
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Minerals yearbook: The mineral industry of the republic of South Africa. 1988 international review, 15:43772 (R;US)

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Militarization of space. June 1970-June 1990 (A Bibliography from the NTIS data base). Report for June 1970-June 1990, 15:45231 (R;US)

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	15:45788	FNAL/C–90/146-E
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	15:46159	PPPL–2708
	15:46160	PPPL–2713
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	15:46256	CONF-8904230–
	15:45770	Published article
	15:46192	Published article
	15:46193	Published article
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	15:46196	Published article
AC02-76ER00038	**Notre Dame Univ., IN (USA). Radiation Lab.**	
	15:44947	DOE/ER/00038–3304
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	15:45695	CONF-8906234–
	15:45808	Published article
	15:45809	Published article
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AC02-76ER03069	**Oak Ridge National Lab., TN (USA)**	
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AC02-76ER03274	**Brookhaven National Lab., Upton, NY (USA)**	
	15:45973	BNL–44774
AC02-76ER13065	**Rochester Univ., NY (USA). Dept. of Physics and Astronomy**	
	15:45782	DOE/ER/13065–634
	15:46126	Published article
AC02-77CH00178		
	15:44832	Published article
AC02-78ET51013	**Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center**	
	15:46143	DOE/ET/51013–283
	15:46144	DOE/ET/51013–284
	15:46188	Published article
AC02-79ER10336		
	15:45702	Published article

Contract No.	Abstract No.	Report No.
AC02-79ET10815	**Tennessee Univ., Tullahoma, TN (USA). Space Inst.**	
	15:44192	DOE/ET/10815–137
	15:44486	DOE/ET/10815–136
AC02-80ER10587		
	15:45827	Published article
	15:45829	Published article
	15:45830	Published article
AC02-80ET15601	**Mississippi State Univ., Mississippi State, MS (USA). Diagnostic Instrumentation and Analysis Lab.**	
	15:44487	DOE/ET/15601–38
AC02-81ER10861		
	15:44927	Published article
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:44168	SERI/TP–254-3799
	15:44515	SERI/TP–255-3537
	15:44135	SERI/TP–211-3896
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	15:44139	SERI/TP–211-3914
AC02-83ER40107	**Brookhaven National Lab., Upton, NY (USA)**	
	15:45973	BNL–44774
AC02-86ER40284		
	15:45885	Published article
AC02-89ER40486	**Lawrence Berkeley Lab., CA (USA). SSC Central Design Group**	
	15:45110	SSC–78
	15:45111	SSC–138
AC03-76SF00098	**Solar Energy Research Inst., Golden, CO (USA)**	
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	15:45754	Published article
	15:45806	Published article
	15:46041	Published article
	15:46184	Published article
AC03-76SF00472	**California Univ., Davis, CA (USA). School of Veterinary Medicine**	
	15:45603	UCD–472-135
AC03-76SF00515	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
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	15:45805	SLAC–367
	15:45875	SLAC–351
	15:45876	SLAC-PUB–5218
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	15:45807	Published article
	15:45886	Published article
AC03-82ER13000	**Lawrence Berkeley Lab., CA (USA)**	
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	15:44775	Published article
AC03-89ER51114		
	15:46252	CONF-8904230–
AC03-89ER53277	**General Atomics, San Diego, CA (USA)**	
	15:46152	GA-A–20000
AC04-76DP00613	**Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.**	
	15:44064	KCP–613-4410
	15:44794	KCP–613-4326
	15:46301	KCP–613-4172
AC04-76DP00789	**New Mexico Bureau of Mines and Mineral Resources, Socorro, NM (USA)**	
	15:45640	CONF-890685–Absts.

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	Sandia National Labs., Albuquerque, NM (USA)	
	15:43694	SAND–90–2145C
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	15:43993	SAND–90–1071C
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	15:44349	SAND–89–2101/3
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	15:45205	SAND–90–0986C
	15:45218	SAND–90–0882C
	15:45660	SAND–90–1317
	15:46054	SAND–90–0189C
	15:46163	SAND–90–1959C
	15:46240	SAND–90–0910C
	15:46241	SAND–90–1002C
	15:46314	SAND–88–3158-Rev.
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	15:46318	SAND–90–2036C
	15:46319	SAND–90–2066C
	15:46320	SAND–90–2067C
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research	
	15:44341	NUREG/CR–5373
	15:45145	CONF-8904230–
	15:44676	Published article
	15:44768	Published article
	15:44823	Published article
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	15:44889	Published article
	15:46178	Published article
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AC04-88DP43495	**EG and G Mound Applied Technologies, Miamisburg, OH (USA)**	
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AC05-76OR00001	**Martin Marietta Energy Systems, Inc., Portsmouth, OH (USA). Quality and Technical Services Div.**	
	15:43907	POEF-T–3535
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	15:46183	Published article
	15:46189	Published article
AC05-84OR21400	**Michigan Univ., Ann Arbor, MI (USA)**	
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	15:44147	ORNL/TM–11519
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	15:44323	CONF-9009219–2
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	15:44365	ORNL/TM–11323
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	15:44421	CONF-9007140–1
	15:44426	ORNL–6627
	15:44432	ORNL/NSP–90/7
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	15:44507	ORNL/M–1226
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	15:44527	ORNL–6626/S1
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	15:44969	ORNL/FTR–3690
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	15:45030	CONF-901088–3

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	15:45047	ORNL/ATD–39
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	15:45338	ORNL/RASA–90/4
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	15:45527	ORNL/FTR–3695
	15:45554	ORNL/TM–11570
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	15:45998	CONF-9005255–1
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	15:46309	ORNL/FTR–3700
	15:46310	ORNL/FTR–3703
	15:43687	ORNL/Sub–86-55936/01
	15:43688	ORNL/Sub–86-95900/02
	15:44068	ORNL/Sub–85-27409/5
	15:44069	ORNL/Sub–85-27413/5
	15:44072	ORNL/Sub–85-27412/5-P1
	15:44599	ORNL/Sub–86-SB195/1
	15:44806	ORNL/ATD–33
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:44220	NUREG/CR–5591-Vol.1-No.1
	15:44234	NUREG/CR–5552
	Oak Ridge National Lab., TN (USA). Applied Technology Div.	
	15:45225	ORNL/ATD–2
	15:46255	CONF-8904230–
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	15:44672	Published article
	15:44673	Published article
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	15:46176	Published article
	15:46199	Published article
AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (USA)**	
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AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	15:46302	K/CSD/TM–94
AC05-86OR21600	**Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center**	
	15:43945	FMPC–2202
	15:43946	FMPC–2214
	15:44006	FMPC–2204
AC06-76RL01830	**Pacific Northwest Lab., Washington, DC (USA)**	
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	Pacific Northwest Lab., Richland, WA (USA)	
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	15:46311	PNL-SA–17302
	15:46312	PNL-SA–18089

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	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:44344	NUREG/CR–5579
	15:44680	Published article
AC06-86NE37963	**Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA)**	
	15:44628	DOE/NE/37963–12
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:43927	WHC-SA–0815
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	15:43998	WHC-EP–0352
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	15:44360	WHC-SA–0817-Rev.1
	15:45351	WHC-EP–0332
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
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	15:44966	EGG-ME–9068
	15:45247	EGG–2612
	15:45588	EGG-BNCT–8777-Vol.4-No.4
	15:45589	EGG-BNCT–8777-Vol.4-No.5
	15:46210	EGG-PRP–9058
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:44342	NUREG/CR–5448
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	15:44343	NUREG/CR–5528
	USDOE Idaho Operations Office, Idaho Falls, ID (USA). Task Force	
	15:43932	DOE/ID–10253
	15:44675	Published article
AC07-88ID12695	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:44572	EGG-M–89481
AC08-80DP40124		
	15:46190	Published article
AC08-88NV10617	**EG and G Energy Measurements, Inc., Las Vegas, NV (USA)**	
	15:45713	EGG–10617-5048
AC08-89NV10630	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)**	
	15:45228	DOE/NV/10630–5
AC21-86MC23075	**Advanced Fuel Research, Inc., East Hartford, CT (USA)**	
	15:43656	DOE/MC/23075–2865
AC21-86MC23247	**Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.**	
	15:43655	CONF-8809162–3
AC21-87MC23293	**Battelle Columbus Div., OH (USA)**	
	15:43657	DOE/MC/23293–2856
AC21-87MC24116	**Coal Technology Corp., Bristol, VA (USA)**	
	15:43658	DOE/MC/24116–2867
AC21-87MC24268	**Riley Stoker Corp., Worcester, MA (USA). Riley Research Center**	
	15:43659	DOE/MC/24268–T3
AC22-85BC10847	**Institute of Gas Technology, Chicago, IL (USA)**	
	15:43786	DOE/BC/10847–20
AC22-86BC14000	**ICF Resources, Inc., Fairfax, VA (USA)**	
	15:43787	DOE/BC/14000–3
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AC22-88PC88853	**Pennsylvania Electric Co., Johnstown, PA (USA)**	
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AC22-89BC14200	**Johns Hopkins Univ., Baltimore, MD (USA)**	
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AC34-90DP62349	**EG and G Rocky Flats, Inc., Golden, CO (USA)**	
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	EG and G Rocky Flats, Inc., Golden, CO (USA). Rocky Flats Plant	
	15:45174	RFP–4435
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	15:45810	Published article
AI08-78ET44802	**Geological Survey, Denver, CO (USA)**	
	15:43996	USGS-OFR–89-234
AS03-88DP10782	**State Univ. of New York, Buffalo, NY (USA). Dept. of Electrical and Computer Engineering**	
	15:45556	DOE/DP/10782–1
AS05-76ER04928		
	15:45828	Published article
AS05-81ER40032	**Brookhaven National Lab., Upton, NY (USA)**	
	15:45973	BNL–44774
AT03-76ET51011	**General Atomics, San Diego, CA (USA)**	
	15:46151	GA-A–15820
FC03-85DP40200	**Rochester Univ., NY (USA). Lab. for Laser Energetics**	
	15:46205	DOE/DP/40200–130
	15:45074	Published article
	15:46264	Published article
	15:46265	Published article
FC05-85ER25000		
	15:46078	Published article
FC07-85ID12612	**Geothermal Resources International, Inc., San Mateo, CA (USA)**	
	15:44158	DOE/ID/12612–1
FC07-88ID12691	**Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry**	
	15:45187	EGG-M–90070
FC07-88ID12708	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:44193	EGG-M–90263
FC07-88ID12793	**Kinetics Technology International Corp., Monrovia, CA (USA)**	
	15:44553	DOE/ID/12793–1
FC21-83FE60177		
	15:43904	Published article
FC21-84MC21136	**New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center**	
	15:43796	DOE/MC/21136–24

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FG01-89CE15437	Hochmuth (Frank W.), Brewer, ME (USA)	
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FG02-85ER60310		
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FG02-86ER13491	Kansas State Univ., Manhattan, KS (USA). J.R. MacDonald Lab.	
	15:45086	DOE/ER/13491-424
FG02-86ER13552	Clarkson Univ., Potsdam, NY (USA)	
	15:44848	DOE/ER/13552-5
FG02-86ER13560	United Technologies Corp., East Hartford, CT (USA). Research Center	
	15:44791	DOE/ER/13560-T1
FG02-86ER13564	Massachusetts Inst. of Tech., Cambridge, MA (USA)	
	15:44868	DOE/ER/13564-8
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FG02-86ER13617	Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry	
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FG02-86ER25013	Cornell Univ., Ithaca, NY (USA)	
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FG02-86ER45253	Colorado School of Mines, Golden, CO (USA). Dept. of Physics	
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FG02-86ER52127	Illinois Univ., Chicago, IL (USA)	
	15:46208	DOE/ER/52127-70
	Illinois Univ., Urbana, IL (USA). Fusion Studies Lab.	
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FG02-86ER60437	Chicago Univ., IL (USA). Enrico Fermi Inst.	
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FG02-87ER53252	Pennsylvania State Univ., University Park, PA (USA). Dept. of Nuclear Engineering	
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FG02-88ER13924	New York Univ. Medical Center, NY (USA). Microbiology Dept.	
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FG02-88ER60634	Nebraska Univ., Lincoln, NE (USA). Dept. of Physics	
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FG02-89ER14039	State Univ. of New York, Binghamton, NY (USA)	
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FG02-89ER40531	Kent State Univ., OH (USA). Dept. of Physics	
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FG02-89ER45401	Sandia National Labs., Albuquerque, NM (USA)	
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FG02-89ER51124	Grumman Aerospace Corp., Princeton, NJ (USA). Corporate Research Center	
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FG03-89FE61811	East-West Center, Honolulu, HI (USA). Resource Systems Inst.	
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	East-West Center, Honolulu, HI (USA). Energy Program	
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FG05-87ER52147	Maryland Univ., College Park, MD (USA). Lab. for Plasma Research	
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FG05-88ER13833	Virginia Commonwealth Univ., Richmond, VA (USA)	
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FG05-88ER40418	Maryland Univ., College Park, MD (USA). Dept. of Chemistry	
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FG05-88ER60654	Duke Univ., Durham, NC (USA). Dept. of Medicine	
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FG05-89ER25080	National Research Council, Washington, DC (USA). Board on Mathematical Sciences	
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FG05-89ER60864	National Academy of Sciences - National Research Council, Washington, DC (USA)	
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FG06-86ER13530	Alaska Univ., Fairbanks, AK (USA). Geophysical Inst.	
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FG06-86ER25019	Washington Univ., Seattle, WA (USA)	
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FG06-87ER13715	Oregon Graduate Center, Beaverton, OR (USA). Dept. of Chemical and Biological Sciences	
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FG06-87ER53242	Washington Univ., Seattle, WA (USA)	
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FG06-87ER53243	Washington Univ., Seattle, WA (USA). Aerospace and Energetics Research Program	
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FG06-88ER40427	Washington Univ., Seattle, WA (USA). Dept. of Physics	
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FG06-89ER60845	Oregon Graduate Inst. of Science and Technology, Beaverton, OR (USA). Dept. of Environmental Science and Engineering	
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FG06-89ER60870	Washington Univ., Seattle, WA (USA)	
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FG06-90ER40537	Washington Univ., Seattle, WA (USA). Nuclear Physics Lab.	
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FG09-89ER14071	Georgia Univ., Athens, GA (USA). Dept. of Biochemistry	
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FG22-86PC90529	Brown Univ., Providence, RI (USA). Div. of Engineering	
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FG22-87PC79928	**Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering**	
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FG22-88PC88929	**Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering**	
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	15:44219	NUREG/CR–5385
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The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
ABE–					
318	15:45154	*See* BMU–1989-238			
ACEEE–					
90015061	15:44494	American Council for an Energy-Efficient Economy, 1001 Connecticut Ave., N.W., Washington, DC 20036 $19.50			
ACS/RR–					
94	15:43833	*See* PB–90-224965/XAB			
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221334/6/XAB	15:44777	NTIS, PC A03/MF A01			
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221872/5/XAB	15:44374	NTIS, PC A03/MF A01			
221894/9/XAB	15:45462	NTIS, PC A13/MF A02			
221919/4/XAB	15:44375	NTIS, PC A03/MF A01			
AERE-R–					
13708	15:46200	Available from HM Stationery Office, London, UK, price Pound 22.00			
13768	15:44615	Available from H.M. Stationery Office, London, price Pound 8.00			
13776	15:45581	Available from H.M. Stationery Office, London, price Pound 94.00			

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AESO–					
1-87	15:45238	*See* AD-A–220920/3/XAB			
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4-85	15:45237	*See* AD-A–220919/5/XAB			
AFIT/CI/CIA–					
90-007D	15:45001	*See* AD-A–221182/9/XAB			
90-008	15:43782	*See* AD-A–220938/5/XAB			
AFME–					
222.500	15:44144	NTIS (US Sales Only), PC A15/MF A01		DE90514552	
82.066.1	15:44141	NTIS (US Sales Only), PC A12/MF A01		DE90514542	
84-350-0277	15:44165	NTIS (US Sales Only), PC A03/MF A01		DE90514538	
85.91.1002.1	15:44141	*See* AFME–82.066.1			
86-91.0003.1	15:44143	NTIS (US Sales Only), PC A03/MF A01		DE90514547	
86.91.0004	15:44495	NTIS (US Sales Only), PC A03/MF A01		DE90514543	
86.91.0004-1	15:44496	NTIS (US Sales Only), PC A04/MF A01		DE90514539	
AFME-FR–					
2	15:44497	NTIS (US Sales Only), PC A10/MF A01		DE90514544	
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AFRRI-TR–					
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ANL–					
89/17	15:44219	*See* NUREG/CR–5385			
90/19	15:44980	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014802	PC-363
90/21	15:43931	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015839	MF-810
90/25	15:45026	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014836	MF-201
ANL/EAIS/TM–					
20	15:44211	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014845	MF-101
ANL/MCT–					
90/1	15:45027	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014809	MF-364
ANU-P–					
1050	15:45934	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636385	
ANU-PRL-TP–					
89/15	15:46134	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635944	
90/1	15:46135	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635945	
AOSTRA–					
012095	15:43902	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: PRICES UPON REQUEST			
ATSDR/HS–					
90/04	15:45619	*See* PB–90-225640/XAB			
90/09	15:45618	*See* PB–90-225624/XAB			
BCEP–					
90-03742	15:45241	PC Western and Northern Canada acid deposition/LRTAP activities, 2nd. Fl., 4999-98th Ave., Edmonton, AB, CAN T6B 2X3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
BF-R–					
40.021	15:44128	Copy held by UB/TIB Hannover			
40.039-2.5	15:44316	Copy held by UB/TIB Hannover			
40.039-7-TN	15:44317	Copy held by UB/TIB Hannover			
BFR-G–					
2-1989	15:44127	Swedish Council for Building Research, Stockholm, Sweden			
BIOLOGICAL–					
85(1.20)	15:45626	*See* PB–90-240821/XAB			
BLM/MT/ES–					
90/003/4111	15:43846	*See* PB–90-232539/XAB			
BMU–					
1989-235	15:44318	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1989-238	15:45154	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			

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BMU–					
1989-240	15:43908	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1990-252	15:44319	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
BNL–					
43176	15:44844	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015094	MF-401
43811R	15:43783	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000248	PC-122
44001	15:45773	NTIS, PC A03/MF A01 - OSTI		DE90015219	MF-405
44002	15:45774	NTIS, PC A05/MF A01 - OSTI		DE90015217	MF-405
44003	15:46283	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015221	MF-405
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44758	15:45519	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015671	MF-408
44774	15:45973	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015095	MF-414
44794	15:44500	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015091	MF-400
44819	15:44685	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015089	MF-404
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44836	15:44320	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015124	MF-406
44859	15:45891	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015682	MF-414
44861	15:45935	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015679	MF-414
44872	15:44786	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015680	MF-401; MF-404
44883	15:45113	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015684	MF-414
44884	15:45114	NTIS, PC A02/MF A01 - OSTI		DE90015685	MF-406
44885	15:45974	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015686	MF-414
44886	15:45101	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015683	MF-414
44897	15:45995	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016324	MF-413
44898	15:45936	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016325	MF-414
44899	15:45115	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016289	MF-414
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44914	15:45116	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016319	MF-414
44939	15:44616	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016323	MF-404; MF-405
44941	15:45975	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016317	MF-414
44942	15:45778	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016315	MF-413
44953	15:45084	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016316	MF-414
44954	15:45779	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016322	MF-414
44963	15:46055	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016311	MF-406
52233	15:43920	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014842	PC-812; PC-814
52245	15:44215	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014815	PC-523
BNL-NUREG–					
44849	15:44321	NTIS, PC A02/MF A01; OSTI; INIS		DE90015127	
BONN-IR–					
90-16	15:45155	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
BRDEC–					
2488	15:44962	*See* AD-A–221033/4/XAB			
BUMINES-IC–					
9238	15:43751	*See* PB–90-224999/XAB			
BIBoS–					
367/89	15:46089	Available from Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)			
384/89	15:46090	Available from Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)			
C-CORE–					
89-11	15:44420	PC Centre for Cold Ocean Resources Engineering, C-CORE, Memorial University of Nfld., St. John's, NF, CAN A1B 3X5; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $24.00 CAN; MF $10 CAN			

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CANMET–					
89-04495	15:43785	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
CAS–					
90-2-1	15:44086	OSTI; College of Administrative Science, The University of Alabama in Huntsville, Huntsville, AL 35899		TI90015559	
CB–					
2017	15:44524	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum			
CBP/TRS–					
18/88	15:45495	*See* PB–90-233933/XAB			
22/88	15:45494	*See* PB–90-233909/XAB			
CBPF-NF–					
080/88	15:46056	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635764	
CBRM-AD–					
90-4	15:45294	*See* PB–90-229782/XAB			
CCOE–					
CE03114	15:44535	TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, AB, CAN T2P 2M1. Prices: $75.00 CAN			
CE–					
02839	15:44367	*See* OH/RD–260T507			
02875	15:44995	*See* TAC–CE02875			
02911	15:44092	*See* EMR/V/CRE–CE02911			
02933	15:44146	*See* FP–12			
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03092	15:44457	*See* OH/GE–02			
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03110	15:44205	*See* RPC–702G606			
03111	15:44201	*See* MC–633G580			
03112	15:44514	*See* RPC–649U4587			
03113	15:44559	*See* OH/RD–709U603			
03114	15:44535	*See* CCOE–CE03114			
03115	15:43891	*See* CGA/ES–CE03115			
CEA-CONF–					
10019	15:46284	NTIS (US Sales Only), PC A03/MF A01		DE90514655	
10020	15:46285	NTIS (US Sales Only), PC A02/MF A01		DE90514654	
10021	15:46286	NTIS (US Sales Only), PC A02/MF A01		DE90514653	
10022	15:44963	NTIS (US Sales Only), PC A02/MF A01		DE90514640	
10027	15:45717	NTIS (US Sales Only), PC A02/MF A01		DE90514651	
10030	15:45983	NTIS (US Sales Only), PC A02/MF A01		DE90514649	
9982	15:43910	NTIS (US Sales Only), PC A02/MF A01		DE90514741	
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CEA-N–					
2620	15:45943	NTIS (US Sales Only), PC A11/MF A01		DE90514683	
CEA-R–					
5513	15:44990	NTIS (US Sales Only), PC A08/MF A01		DE90514564	
5514	15:43906	NTIS (US Sales Only), PC A07/MF A01		DE90514566	
5517	15:44686	NTIS (US Sales Only), PC A09/MF A01		DE90514565	
CEC–					
90015481	15:43810	OSTI; California Energy Commission, 1516 Ninth Street-MS 13, Sacramento, CA 95814		TI90015481	

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CEGB-RD-B–					
6147/R89	15:44282	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636996	
6284/R89	15:44991	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636984	
CEGB-RD-M–					
1712/RR88	15:44617	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636544	
CEGB-TD-B–					
6305/R89	15:44618	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636566	
CEGB-TD/B–					
6259/R89	15:44224	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90637072	
CEPN–					
138	15:43921	NTIS (US Sales Only), PC A07/MF A01		DE90514563	
164	15:45583	NTIS (US Sales Only), PC A03/MF A01		DE90514714	
CERI–					
90-01031	15:43811	PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
90-01036	15:43822	PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $100.00 CAN; MF $10 CAN			
CFA–					
89-2985	15:45672	*See* N–90-22426			
CGA/ES–					
CE03115	15:43891	Canadian Gas Association, 55 Scarsdale Rd, Don Mills, ON, CAN M3B 2R3. Prices: N/C			
CLM-R–					
298	15:46202	Available from HM Stationery Office, London, price Pound 10.00			
CMHC–					
90-03779	15:44501	PC Canada Mortgage and Housing Corporation, Annex Bldg., 682 Montreal Rd., Ottawa, ON, CAN K1A 0P7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
CMU-CS–					
83-158	15:46276	*See* AD-A–221568/9/XAB			
COGLA–					
90-03338	15:44466	PC Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, Ont., CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
CONF-8209314–		(Advanced coal gasification symposium; Beijing (China); 20-28 Sep 1982)			
	15:43689	*See* PB–89-166136			
CONF-8306309–		(2. advanced coal gasification symposium; Shanghai (China); 27 Jun - 2 jul 1983)			
	15:43690	*See* PB–89-166144			
CONF-8503301–		(Industrial briefing to Bechtel/LLNL consortium; Livermore, CA (USA); 26 Mar 1985)			
1	15:44701	*See* UCRL–94136			
CONF-8504346–		(3. advanced coal gasification symposium; Beijing (China); 30 Apr - 3 may 1985)			
	15:43691	*See* PB–89-166151			
CONF-8506292–		(5. international colloquium on plasmas and cathodic sputtering; Antibes (France); 10-14 Jun 1985)			
	15:44144	*See* AFME–222.500			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-860433–		(International workshop on the dynamic behavior of wind turbines; Sophia Antipolis (France); 28-30 Apr 1986)			
	15:44166	NTIS (US Sales Only), PC A11/MF A01		DE90514553	
CONF-8703337–		(Small hydro Canada '87; Burnaby (Canada); 24-27 Mar 1987)			
	15:44092	*See* EMR/V/CRE–CE02911			
CONF-8705407–		(Colloquium on thermal comfort in summer; Aix-en-Provence (France); 5 May 1987)			
	15:44497	*See* AFME-FR–2			
CONF-8707226–		(International conference on nuclear fuel reprocessing waste management - RECOD '87; Paris (France); 23 Jul 1987)			
1	15:43915	*See* ETDE-IT–90-48			
CONF-8709344–		(6. annual international oil and gas markets conference; Calgary (Canada); 28-29 Sep 1987)			
	15:43822	*See* CERI–90-01036			
CONF-8709496–		(5. advanced coal gasification symposium; Taiyuan (China); 14-18 Sep 1987)			
	15:43692	*See* PB–89-166177			
CONF-8803272–		(Cogeneration: experience and prospects in Ontario; Mississauga (Canada); 10 Mar 1988)			
	15:44560	*See* OME–90-01732			
CONF-8804331–		(Surface-crack growth: models, experiments, and structures symposium; Sparks, NV (USA); 25 Apr 1988)			
	15:44660				
CONF-8805382–		(53. symposium on the molecular biology of signal transduction; Cold Spring Harbor, NY (USA); 25 May - 1 jun 1988)			
Pt.1	15:45520	Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724			ND-408
Pt.2	15:45521	Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724			ND-408
CONF-8805383–		(Information symposium on improving productivity through technology; Luxembourg (Luxembourg); 4-6 May 1988)			
	15:43728	*See* EUR–12101			
CONF-8806487–		(Technical committee meeting and workshop on criteria for the introduction of advanced nuclear power technologies for specific applications in developing countries; Vienna (Austria); 27 Jun 1988)			
	15:44263	*See* IAEA-TECDOC–541			
CONF-880752–		(International symposium on teleoperation and control; Bristol (UK); 12-15 Jul 1988)			
5	15:43909	*See* ETDE-IT–90-49			
CONF-880781–		(16. international symposium on rarefied gas dynamics; Pasadena, CA (USA); 11-15 Jul 1988)			
	15:45758				
	15:45759				
CONF-8808238–		(North Sun '88: international conference on solar energy at high latitudes and exhibition; Borlaenge (Sweden); 29-31 Aug 1988)			
	15:44127	*See* BFR-G–2-1989			
CONF-880906–		(7. international conference on radiation shielding; Bournemouth (UK); 12-16 Sep 1988)			
14	15:46043	*See* ETDE-IT–90-20			
15	15:46044	*See* ETDE-IT–90-26			
16	15:46299	*See* ETDE-IT–90-51			
CONF-8809162–		(Advanced Research and Technology Development (AR&TD) direct utilization, instrumentation, and diagnostics contractors review meeting; Pittsburgh, PA (USA); 6-9 Sep 1988)			
3	15:43655	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015967	MF-103

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-880920–		(International symposium on energy options for the year 2000: contemporary concepts in technology and policy; Wilmington, DE (USA); 14-17 Sep 1988)			
	15:44080	University of Delaware, Newark, DE 19716 (USA)			
	15:44585	University of Delaware, Newark, DE 19716 (USA)			
CONF-880965–		(20. IEEE photovoltaic specialists conference; Las Vegas, NV (USA); 26-30 Sep 1988)			
26	15:44131	*See* ETDE-IT–90-07			
CONF-881020–		(4. international symposium on radiation physics (ISRP-4); Sao Paulo (Brazil); 3-7 Oct 1988)			
2	15:44027	*See* ETDE-IT–90-50			
CONF-8810289–		(11. All-Union conference on charged particle accelerators; Dubna (USSR); 25-27 Oct 1988)			
2	15:45086	*See* DOE/ER/13491–424			
CONF-8810321–		(Workshop on crystalline ion beams; Wertheim (Germany, F.R.); 4-7 Oct 1988)			
	15:45081	*See* GSI–89-10			
CONF-881125–		(3. international symposium on ceramic materials and components for engines; Las Vegas, NV (USA); 27-30 Nov 1988)			
	15:44705				
CONF-881127–		(Conference on the science and technology of thin film superconductors; Colorado Springs, CO (USA); 14-18 Nov 1988)			
6	15:46080	*See* DOE/ER/45297–13			
CONF-8811331–		(Technical committee on user requirements for decision support systems; Vienna (Austria); 28 Nov 1988)			
	15:44290	*See* IAEA-TECDOC–529			
CONF-881141–		(Superfund '88: 9th national conference and exhibition on hazardous waste; Washington, DC (USA); 28-30 Nov 1988)			
	15:44395	Hazardous Materials Control Research Institute, 9300 Columbia Blvd., Silver Springs, MD 20910			
CONF-881185–		(International workshop on liquid state electronics; Berlin (Germany, F.R.); 7-10 Nov 1988)			
2	15:45606	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016016	MF-408
CONF-890114–		(14. workshop on geothermal reservoir engineering; Stanford, CA (USA); 24-26 Jan 1989)			
6	15:44153	*See* LBL–26872			
8	15:44152	*See* LBL–26871			
9	15:44161	*See* LBL–26870			
CONF-8902181–		(International symposium on inhalation toxicology; Hannover (Germany, F.R.); 19-24 Feb 1989)			
1	15:45611	*See* ETDE-IT–90-33			
CONF-8903172–		(10. Biennial studies session on nuclear physics; Aussois (France); 6-10 Mar 1989)			
	15:45720	*See* LYCEN–89-02			
CONF-8903231–		(Final research co-ordination meeting on radiotracer studies of fungicide residues in food plants; Ankara (Turkey); 13 Mar 1989)			
	15:45612	*See* IAEA-TECDOC–554			
CONF-8903236–		(19. Actinides Meeting; Madonna di Campiglio (Italy); 29-31 Mar 1989)			
	15:43910	*See* CEA-CONF–9982			
	15:43911	*See* CEA-CONF–9983			
CONF-890417–		(INFO '89; New Orleans, LA (USA); 16-19 Apr 1989)			
2	15:44329	*See* ETDE-IT–90-42			
CONF-8904230–		(AVS topical conference on surface conditioning of vacuum systems; Los Angeles, CA (USA); 3-5 Apr 1989)			
	15:45145				
	15:45146				
	15:46251				
	15:46252				

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	15:46253				
	15:46254				
	15:46255				
	15:46256				
CONF-890425–		(American power conference; Chicago, IL (USA); 24-26 Apr 1989)			
	15:44313				
	15:44451				
	15:44481				
	15:46088				
CONF-8904259–		(American Society for Precision Engineering spring conference; Tucson, AZ (USA); 25-27 Apr 1989)			
3	15:46055	*See* BNL–44963			
CONF-890437–		(Corrosion '89; New Orleans, LA (USA); 17-21 Apr 1989)			
	15:43760	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218 (USA)			
	15:43761	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218 (USA)			
	15:44001	National Assoc. of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218 (USA)			
CONF-8904371–		(International topical meeting on pressure vessel technology and nuclear codes and standards; Seoul (C is not a valid Country Code.); 19 Apr 1989)			
3	15:44248	*See* ETDE-IT–90-43			
CONF-890478–		(12. world conference on non-destructive testing; Amsterdam (Netherlands); 23-28 Apr 1989)			
2	15:44993	*See* ETDE-IT–90-34			
CONF-8905112–		(ASTM symposium on the applications of automation technology to fatigue and fracture testing; Kansas City, MO (USA); 22-23 May 1989)			
4	15:44992	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015797	MF-406
CONF-8905143–		(NATO advanced study institute international advanced course on the nuclear equation of state; Peniscola (Spain); 12 May - 3 jun 1989)			
	15:45717	*See* CEA-CONF–10027			
CONF-8905219–		(Conference on CP violation in particle physics and astrophysics; Blois (France); 22-26 May 1989)			
	15:45796	*See* LAL–89-26			
	15:45798	*See* LAL–89-29			
CONF-8905323–		(International conference on pyrolysis and gasification; Luxembourg (Luxembourg); 23-25 May 1989)			
	15:43679	*See* EUR–12479			
CONF-8905340–		(RISO international conference on environmental models: Emissions and consequences; Riso (Denmark); 22 May 1989)			
1	15:44389	*See* ETDE-IT–90-38			
CONF-8905341–		(11. annual symposium on safeguard and nuclear material management; Luxembourg (Luxembourg); 30 May 1989)			
1	15:44012	*See* ETDE-IT–90-35			
CONF-890544–		(2. International conference on radioactive waste management; Brighton (UK); 2-5 May 1989)			
1	15:43943	*See* ETDE-IT–90-40			
CONF-890545–		(6. conference on real-time computer applications in nuclear, particle and plasma physics; Williamsburg, VA (USA); 15-19 May 1989)			
	15:45166	*See* LAL-RT–89-08			
CONF-890555–		(7. power plant dynamics, control and testing symposium; Knoxville, TN (USA); 15-17 May 1989)			
25	15:44330	*See* ETDE-IT–90-45			

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CONF-890564–		(ISWA-conference on waste minimization and clean technology: moving towards the 21st century; Geneva (Switzerland); 29 May - 1 jun 1989)			
2	15:44555	*See* ETDE-IT–90-19			
CONF-8906160–		(Yamada conference on nuclear weak processes and nuclear structure; Osaka (Japan); 12-15 Jun 1989)			
	15:45983	*See* CEA-CONF–10030			
CONF-8906204–		(International symposium on heavy quark physics; Ithaca, NY (USA); 13-17 Jun 1989)			
	15:45797	*See* LAL–89-27			
CONF-8906234–		(Workshop on astrophysics in Antarctica; Newark, DE (USA); 8-10 Jun 1989)			
	15:45694				
	15:45695				
	15:45696				
CONF-890628–		(30. US symposium on rock mechanics; Morgantown, WV (USA); 19-22 Jun 1989)			
13	15:45651	*See* LBL–26594			
CONF-890631–		(PATRAM '89: international symposium on the packaging and transportation of radioactive materials; Washington, DC (USA); 11-16 Jun 1989)			
	15:44963	*See* CEA-CONF–10022			
CONF-8906344–		(Conference on medical response to effects of ionising radiation; London (UK); 28 Jun 1989)			
	15:44357	*See* SRD-R–512			
CONF-8906350–		(Workshop on the improvement of feedstock quality; Toronto (Canada); 29 Jun 1989)			
1	15:44082	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015181	MF-242
CONF-8906351–		(5. IAERU seminar; Tokyo (Japan); 24 Jun 1989)			
	15:46057	*See* IAERU–8904			
CONF-8906352–		(Reliability' 89 Conference; Brighton (UK); 14-16 Jun 1989)			
	15:46284	*See* CEA-CONF–10019			
CONF-890685–		(International Association of Volcanology and Chemistry of the Earth's Interior; Santa Fe, NM (USA); 24 Jun - 1 jul 1989)			
Absts.	15:45640	NTIS, PC A15/MF A01 - OSTI		DE90015514	MF-700
CONF-890697–		(NATO Advanced Study Institute on non-equilibrium processes in partially ionized gases; Acquafredda di Maratea (Italy); 4-17 Jun 1989)			
4	15:45033	*See* ENEA-RT-TIB–89-27			
CONF-8907103–		(Conference on technology-based confidence building: energy and environment; Santa Fe, NM (USA); 9-14 Jul 1989)			
13	15:44433	*See* UCRL–101627			
CONF-8907113–		(5. international conference on environmental mutagens; Cleveland, OH (USA); 10-15 Jul 1989)			
14	15:45607	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016015	MF-408
CONF-8907130–		(9. international conference on vacuum ultraviolet radiation physics; Honolulu, HI (USA); 17-21 Jul 1989)			
6	15:45057	*See* UCRL–101555			
CONF-890721–		(Joint ASME/JSME pressure vessel and piping conference; Honolulu, HI (USA); 23-27 Jul 1989)			
	15:44246	*See* CEA-CONF–9987			
	15:44281	*See* CEA-CONF–9986			
	15:46285	*See* CEA-CONF–10020			
	15:46286	*See* CEA-CONF–10021			
CONF-8907212–		(85. PTB seminar on product control of radioactive waste; Braunschweig (Germany, F.R.); 17-18 Jul 1989)			
	15:43970	*See* PTB-SE–25			
CONF-890803–		(International conference on high energy accelerators; Tsukuba (Japan); 20-26 Aug 1989)			
	15:45105	*See* LAL-RT–89-05			

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	15:45152	*See* LAL-RT–89-10			
CONF-8908134–		(11. international free electron laser conference; Naples, FL (USA); 28 Aug - 1 sep 1989)			
31	15:46204	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90011085	MF-420
CONF-890819–		(ASME/AIChE national heat transfer conference; Philadelphia, PA (USA); 6-9 Aug 1989)			
28	15:44289	*See* ETDE-IT–90-37			
CONF-8908221–		(1. international seminar on seismic base isolation for nuclear power facilities; San Francisco, CA (USA); 21-22 Aug 1989)			
1	15:44328	*See* ETDE-IT–90-09			
CONF-8908245–		(Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities; Kumatori (Japan); KUMATORI (is not a valid Country Code.); 2-3 Aug 1989; 22 feb 1990)			
	15:46059	*See* KURRI-TR–330			
CONF-8908246–		(Workshop on supercomputing astrophysics; Tsukuba (Japan); 31 Aug - 2 sep 1989)			
	15:45668	*See* KEK-PR–89-2			
CONF-8908247–		(Workshop on 'radiation protection in LINACs'; Kumatori (Japan); 8 Aug 1989)			
	15:45135	*See* KURRI-TR–324			
CONF-8908248–		(IAEA-Befast 2 meeting; Helsinki (Finland); 28 Aug 1989)			
1	15:43923	*See* ETDE-IT–90-22			
CONF-8908249–		(9th international clay conference A.I.P.E.A; Strasbourg (France); 28 Aug 1989)			
1	15:43940	*See* ENEA-RT-COMB–89-19			
CONF-890855–		(10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989)			
	15:44361	American Association for Structural Mechanics in Reactor Technology, P.O. Box 60860, Los Angeles, CA 90060 (USA)			
	15:44362	American Association for Structural Mechanics in Reactor Technology, P.O. Box 60860, Los Angeles, CA 90060 (USA)			
CONF-8909101–		(Workshop on tritium and advanced fuels in fusion reactors; Varenna (Italy); 6-15 Sep 1989)			
1	15:46207	*See* DOE/ER/52127–67			
CONF-890921–		(International congress on progress and innovation in tunnelling; Toronto (Canada); 9-14 Sep 1989)			
	15:44995	*See* TAC–CE02875			
CONF-890923–		(World congress of the International Solar Energy Society; Kobe (Japan); 4-8 Sep 1989)			
3	15:44484	*See* ETDE-IT–90-57			
CONF-890932–		(International meeting on power stations; Liege (Belgium); 25-29 Sep 1989)			
1	15:44226	*See* ETDE-IT–90-44			
CONF-8909354–		(13. conference on the numerical simulation of plasmas; Santa Fe, NM (USA); 17 Sep 1989)			
Exc.	15:46145	*See* ENEA-RT-FUS–89-11			
CONF-8909355–		(75. annual meeting of the Italian Physical Society; Cagliari (Italy); 28 Sep 1989)			
1	15:45041	*See* ETDE-IT–90-27			
2	15:45042	*See* ETDE-IT–90-28			
CONF-8909356–		{Understanding of cold fusion phenomena; Varenna (Italy); 15 Sep 1989)			
1	15:46130	*See* ENEA-RT-FUS–89-12			
2	15:46042	*See* ENEA-RT-FUS–89-20			
CONF-890993–		(6. conference on computing in civil engineering; Atlanta, GA (USA); 11-13 Sep 1989)			
2	15:46287	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015965	MF-405
CONF-891008–		(International symposium on safety assessment of radioactive waste repositories; Paris (France); 9-12 Oct 1989)			
7	15:43959	*See* LBL–26852			

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CONF-8910111–		(International symposium on selected topics on radiation protection; Dubrovnik (Yugoslavia); 2-6 Oct 1989)			
1	15:45252	*See* ETDE-IT–90-06			
CONF-8910120–		(1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989)			
1	15:43942	*See* ETDE-IT–90-29			
CONF-8910354–		(DNA damage and repair in human tissues conference; Upton, NY (USA); 1-4 Oct 1989)			
3	15:45585	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015536	MF-408
CONF-8910443–		(International symposium on boundary element methods (ISBEM); East Hartford (C is not a valid Country Code.); 2 Oct 1989)			
1	15:44167	*See* ETDE-IT–90-21			
CONF-8910445–		(8. CERI [Canadian Energy Research Institute] international oil and gas markets conference; Calgary (Canada); 22-24 Oct 1989)			
	15:43811	*See* CERI–90-01031			
CONF-8910446–		(7. European annual conference on human decision making and manual control; Paris (France); 18 Oct 1989)			
1	15:44243	*See* ETDE-IT–90-24			
CONF-891050–		(2. international conference on CANDU fuel; Chalk River (Canada); 1-5 Oct 1989)			
1	15:44242	*See* ENEA-RT-COMB–89-23			
CONF-891057–		(International symposium on borehole geophysics for minerals, geotechnical, and groundwater applications; Las Vegas, NV (USA); 2-5 Oct 1989)			
Vol.1	15:45641	NTIS, PC A17/MF A01; Publications Office, Geological Society of Canada, 6001 Booth Street, Ottawa, Ontario, Canada K1A-0E8 $21.00		DE90015513	
CONF-891070–		(2. international conference on separation science and technology; Hamilton (Canada); 1-4 Oct 1989)			
	15:44846	*See* CSCHE–CE0389-Vol.1			
	15:44847	*See* CSCHE–CE03090-Vol.2			
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989)			
135	15:44786	*See* BNL–44872			
CONF-8911192–		(1989 Boulder damage symposium; Boulder, CO (USA); 1-3 Nov 1989)			
6	15:46242	*See* UCRL–101768			
CONF-8911215–		(EGRET: energetic gamma-ray experiment telescope science symposium; Greenbelt, MD (USA); 15-16 Nov 1989)			
	15:45169	*See* N–90-23294			
CONF-8911216–		(Workshop on nuclear structure of light nuclei far from stability; Overnai (France); 27-29 Nov 1989)			
1	15:45953	*See* LBL–29143			
CONF-8911217–		(1989 fuel oil utilization workshop; Clearwater Beach, FL (USA); 1-2 Nov 1989)			
	15:44197	*See* EPRI-GS–6919			
CONF-8911218–		(Workshop on static electrification in power transformers; Princeton, NJ (USA); 15-17 Nov 1989)			
	15:44194	*See* EPRI-EL–6918			
CONF-891204–		(4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989)			
38	15:46238	*See* PNL-SA–18388			
39	15:46215	*See* ETDE-IT–90-05			
CONF-891206–		(International chemical congress of Pacific Basin Societies (PACIFICHEM '89); Honolulu, HI (USA); 17-22 Dec 1989)			
13	15:44844	*See* BNL–43176			
CONF-8912108–		(Conference on advanced computer technology for the power industry; Scottsdale, AZ (USA); 4-6 Dec 1989)			
	15:44198	*See* EPRI-MD–6881-Vol.1			

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Vol.2	15:44199	*See* EPRI-MD–6881-Vol.2			
CONF-8912109–		(Scrap tire seminar; Philadelphia, PA (USA); 4 Dec 1989)			
1	15:44572	*See* EGG-M–89481			
CONF-900102–		(13. energy-sources technology conference and exhibition; New Orleans, LA (USA); 14-18 Jan 1990)			
	15:44169	American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017 (USA)			
CONF-9001104–		(1. technical symposium on soft x-ray projection lithography; Pacific Grove, CA (USA); Jan 1990)			
1	15:44788	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015353	MF-700
CONF-9001108–		(2. specialist research meeting on studies of nuclear chemistry and nuclear physics at research reactor; Kumatori (Japan); 17-18 Jan 1990)			
	15:45908	*See* KURRI-TR–333			
CONF-9001109–		(Specialists' meeting on radioactive wastes management; Kumatori (Japan); 23-24 Jan 1990)			
	15:43953	*See* KURRI-TR–331			
CONF-900115–		(15. workshop on geothermal reservoir engineering; Stanford, CA (USA); 23-25 Jan 1990)			
3	15:44159	*See* LBL–28851			
CONF-900125–		(3. international conference on low-level measurements of actinides and long-lived radionuclides in biological and environmental samples; Bombay (India); 29 Jan - 2 feb 1990)			
1	15:45511	*See* PNL-SA–17438			
CONF-900143–		(Institute for Electronic and Electrical Engineers (IEEE) nuclear science symposium; San Francisco, CA (USA); 15-19 Jan 1990)			
36	15:45167	*See* LBL–29001			
CONF-900144–		(Ionizing radiation damage to DNA: molecular aspects; Lake Tahoe, CA (USA); 16-21 Jan 1990)			
	15:45584	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014562	MF-408
CONF-900163–		(Conference on computer codes and the linear accelerator community; Los Alamos, NM (USA); 22-25 Jan 1990)			
	15:45097	*See* LA–11857-C			
CONF-900170–		(ITER workshop; Princeton, NJ (USA); 10 Jan 1990)			
2	15:46208	*See* DOE/ER/52127–70			
CONF-9002111–		(Data analysis and interpretation for environmental surveillance conference; Lexington, KY (USA); 5-7 Feb 1990)			
2	15:45243	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016026	MF-402
CONF-9002117–		(Workshop on parity violation in electron scattering; Pasadena, CA (USA); 22-24 Feb 1990)			
4	15:46003	*See* DOE/ER/40427–05-N90			
CONF-9002131–		(Workshop on asymptotic analysis and numerical solution of partial differential equations; Argonne, IL (USA); 26-28 Feb 1990)			
2	15:46324	*See* UCRL-JC–104693			
CONF-9002138–		(Workshop on development and application of low temperature irradiation and irradiation facilities; Workshop on development and application of low temperature irradiation and irradiation facilities; Kumatori (Japan); KUMATORI (is not a valid Country Code.); 2-3 Aug 1989; 22 feb 1990)			
	15:46059	*See* KURRI-TR–330			
CONF-900242–		(4. OSA topical meeting on optical remote sensing of the atmosphere; Incline Village, NV (USA); 12-15 Feb 1990)			
1	15:45254	*See* ETDE-IT–90-12			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-900280–		(International workshop on magnetic pulse compression; Lake Tahoe, NV (USA); 12-14 Feb 1990)			
4	15:45112	*See* UCRL-JC–104643			
CONF-900295–		(6. workshop on nuclear dynamics; Jackson Hole, WY (USA); 17-24 Feb 1990)			
7	15:45892	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015284	MF-413
CONF-9003175–		(Les Rencontres de Physique de la Vallee D'Aosta; La Thuile (Italy); 18-24 Mar 1990)			
3	15:45786	*See* FNAL/C–90/138-E			
CONF-9003186–		(45. annual meeting of the physics society of Japan; Osaka (Japan); 30 Mar - 2 apr 1990)			
1	15:45734	*See* UCRL-JC–104238			
CONF-9003187–		(Residential heating in the 1990's; Halifax (Canada); 26-27 Mar 1990)			
1	15:44500	*See* BNL–44794			
CONF-9003189–		(3. ultrafast laser probe phenomena in bulk and microstructure semiconductors; San Diego, CA (USA); 18-19 Mar 1990)			
1	15:46064	*See* LBL–29175			
CONF-9003190–		(NATO advanced workshop on light scattering in semiconductors and microstructures; Quebec (Canada); 5-9 Mar 1990)			
1	15:46063	*See* LBL–29174			
CONF-900331–		(Workshop on heavy ion physics at the alternating gradient synchrotron; Upton, NY (USA); 3-7 Mar 1990)			
13	15:45780	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015541	MF-414
CONF-900348–		(2. international industrial symposium on the super collider; Miami, FL (USA); 14-16 Mar 1990)			
13	15:45118	*See* FNAL-TM–1671			
CONF-900367–		(1. international symposium on particles, strings and cosmology; Boston, MA (USA); 27-31 Mar 1990)			
1	15:45788	*See* FNAL/C–90/146-E			
2	15:45799	*See* LA-UR–90-2631			
CONF-900368–		(International conference on optical science and engineering; Hague (Netherlands); 12-16 Mar 1990)			
5	15:45028	NTIS (US Sales Only), PC A02/MF A01		DE90514418	
8	15:44787	NTIS (US Sales Only), PC A03/MF A01		DE90514493	
CONF-900384–		(American Physical Society meeting; Anaheim, CA (USA); 12-16 Mar 1990)			
2-Absts.	15:45899	*See* ETDE-IT–90-10			
CONF-900402–		(Annual meeting of the Division of Physics of Beams of the American Physical Society; 199. national meeting of the American Chemical Society; Washington, DC (USA); Boston, MA (USA); 16-19 Apr 1990; 22-27 apr 1990)			
8	15:45670	*See* LBL–29101			
CONF-900406–		(1. international topical meeting on high-level radioactive waste management; Las Vegas, NV (USA); 8-12 Apr 1990)			
71	15:43967	*See* PNL-SA–17391			
72	15:44011	*See* UCRL–102115			
74	15:43969	*See* PNL-SA–17771			
75	15:45346	*See* PNL-SA–17922			
CONF-9004131–		(The national energy strategy–the role of geothermal technology development; San Francisco, CA (USA); 18-20 Apr 1990)			
7	15:44160	*See* LBL–29045			
CONF-900419–		(8. international triennial conference on thin films and the 17th international conference on metallurgical coatings; San Diego, CA (USA); 1-6 Apr 1990)			
7	15:45043	*See* ETDE-IT–90-58			
CONF-9004209–		(Workshop on the science of intense radioactive ion beams; Los Alamos, NM (USA); 10-12 Apr 1990)			
6	15:45687	*See* UCRL-JC–104603			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9004213–		(International conference on solenoidal detectors for the SSC; Tsukuba (Japan); 23-25 Apr 1990)			
4	15:45787	*See* FNAL/C–90/139-E			
CONF-9004231–		(Conference on iterative methods; Copper Mountain, CO (USA); 1-5 Apr 1990)			
2	15:46297	*See* DOE/ER/25026–37			
CONF-9004237–		(Electrotechnologies national conference; Calgary (Canada); 2-3 Apr 1990)			
	15:44535	*See* CCOE–CE03114			
CONF-9004238–		(23. international symposium on remote sensing of environment; Bangkok (Thailand); 18 Apr 1990)			
1	15:45189	*See* ETDE-IT–90-17			
CONF-900436–		(International magnetics conference; Brighton (UK); 17-20 Apr 1990)			
1	15:45119	*See* FNAL-TM–1672			
CONF-900450–		(Nuclear structure in the '90's; Oak Ridge, TN (USA); 23-27 Apr 1990)			
7	15:45978	*See* LBL–29160			
8	15:45100	*See* LBL–29256			
9	15:45948	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015787	MF-413
CONF-900466–		(Spring meeting of the Materials Research Society; San Francisco, CA (USA); 16-21 Apr 1990)			
75	15:44796	*See* LBL–29036			
76	15:44702	*See* UCRL–102335			
77	15:46083	*See* LBL–29215			
78	15:44700	*See* SAND–90-1639C			
79	15:44866	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015800	MF-401; MF-404
80	15:44619	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016031	MF-404
81	15:44656	*See* UCRL–102337			
CONF-900476–		(IAH conference on subsurface contamination by immiscible fluids; Calgary (Canada); 18-20 Apr 1990)			
1	15:45345	*See* PNL-SA–17612			
CONF-900489–		(5. international conference on muon spin rotation, relaxation and resonance; Oxford (UK); 9-12 Apr 1990)			
2	15:44685	*See* BNL–44819			
CONF-900495–		(Annual meeting of the Division of Physics of Beams of the American Physical Society; 199. national meeting of the American Chemical Society; Washington, DC (USA); Boston, MA (USA); 16-19 Apr 1990; 22-27 apr 1990)			
1	15:45670	*See* LBL–29101			
CONF-9005113–		(Seminar on methods and codes for assessing the offsite consequences of nuclear accidents; Athens (Greece); 7-11 May 1990)			
1	15:44010	*See* PNL-SA–18092			
CONF-900512–		(12. symposium on biotechnology for fuels and chemicals; Gatlinburg, TN (USA); 7-11 May 1990)			
3	15:44077	*See* EGG-M–89498			
CONF-9005221–		(Interface between nuclear structure and heavy-ion reaction dynamics conference; Notre Dame, IN (USA); 24-26 May 1990)			
7	15:45982	*See* UCRL-JC–103563			
8	15:45963	*See* LBL–29135			
CONF-9005233–		(2. international conference on medium- and high-energy physics; Taipei (Taiwan); 8-18 May 1990)			
3	15:45781	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015789	MF-414
CONF-9005237–		(10. annual conference on nonlinear science: the next decade; Los Alamos, NM (USA); 21-25 May 1990)			
3	15:46107	*See* LA-UR–90-2272			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9005245–		(International workshop on correlations and multiparticle production (CAMP); Marburg (Germany, F.R.); 14-16 May 1990)			
2	15:45782	*See* DOE/ER/13065–634			
CONF-9005247–		(International conference on radiation material science; Alushta (USSR); 22-25 May 1990)			
2	15:46236	*See* PNL-SA–17897			
3	15:46235	*See* PNL-SA–17896			
CONF-9005248–		(Evolution in astrophysics: IUE astronomy in the era of new space missions; Toulouse (France); 29 May - 1 jun 1990)			
4	15:45669	*See* LA-UR–90-2374			
CONF-9005254–		(3. international spring seminar on nuclear physics: understanding the variety of nuclear excitations; Ischia (Italy); 21-25 May 1990)			
1	15:45997	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015161	MF-413
CONF-9005255–		(25. Zakopane school of physics conference; Zakopane (Poland); 5-12 May 1990)			
1	15:45998	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015174	MF-413
CONF-9005256–		(7. annual veterinary medicine forum; San Diego, CA (USA); 25-28 May 1990)			
1	15:45541	*See* PNL-SA–16891			
CONF-900527–		(ICMC '90 topical symposium on high temperature superconductors: materials aspects; Garmisch-Partenkirchen (Germany, F.R.); 9-11 May 1990)			
3	15:44697	*See* LBL–29216			
CONF-900563–		(7. symposium on radiation measurements and applications; Ann Arbor, MI (USA); 21-24 May 1990)			
16	15:44799	*See* LBL–29248			
CONF-900570–		(8. international conference on ultrarelativistic nucleus-nucleus collisions: Quark Matter '90; Menton (France); 7-11 May 1990)			
2	15:45891	*See* BNL–44859			
3	15:45974	*See* BNL–44885			
4	15:45975	*See* BNL–44941			
5	15:45116	*See* BNL–44914			
6	15:45995	*See* BNL–44897			
7	15:45936	*See* BNL–44898			
8	15:45800	*See* LA-UR–90-2776			
CONF-900577–		(Symposium on surface processing and laser assisted chemistry in conjunction with the spring meeting of the European Materials Research Society; Strasbourg (France); 29 May - 1 jun 1990)			
1	15:44695	*See* LBL–28669			
CONF-900601–		(12. international conference on particles and nuclei; Cambridge, MA (USA); 24-29 Jun 1990)			
3	15:45935	*See* BNL–44861			
4	15:45779	*See* BNL–44954			
5	15:45778	*See* BNL–44942			
CONF-900603–		(2. European particle accelerator conference; Nice (France); 11-16 Jun 1990)			
30	15:46247	*See* UCRL-JC–104159			
31	15:45098	*See* LBL–29228			
32	15:45103	*See* FNAL/C–90/140			
CONF-900605–		(Annual convention and exposition of the American Association of Petroleum Geologists; San Francisco, CA (USA); 3-6 Jun 1990)			
	15:43865				
CONF-900607–		(Advances in human factors research on man-computer interactions: nuclear and beyond; Nashville, TN (USA); 10-15 Jun 1990)			
6	15:46311	*See* PNL-SA–17302			
CONF-900610–		(22. national symposium on fracture mechanics; Atlanta, GA (USA); 26-28 Jun 1990)			
1	15:44283	NTIS, PC A03/MF A01 - OSTI		DE90015597	

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CONF-9006111–		(Conference on mesoscale processes and mountain meteorology; Boulder, CO (USA); 25-29 Jun 1990)			
5	15:45322	*See* PNL-SA–17954			
CONF-9006176–		(19. power modulator symposium; San Diego, CA (USA); Jun 1990)			
12	15:45059	*See* UCRL-JC–103327			
13	15:45114	*See* BNL–44884			
14	15:45113	*See* BNL–44883			
CONF-9006179–		(5. national conference on high-power microwave technology; West Point, NY (USA); 10-15 Jun 1990)			
5	15:45232	*See* UCRL–102625			
CONF-9006195–		(Free Lagrange conference; Jackson Lake, WY (USA); 3-7 Jun 1990)			
7	15:46166	*See* UCRL-JC–104241			
8	15:46323	*See* UCRL-JC–104630			
CONF-9006220–		(28. COSPAR plenary conference; The Hague (Netherlands); 25 Jun - 6 jul 1990)			
3	15:45597	*See* PNL-SA–17906			
CONF-9006221–		(Annual technology transfer society meeting; Dayton, OH (USA); 28 Jun 1990)			
3	15:44427	*See* PNL-SA–17857			
CONF-9006228–		(1990 annual charged particle beam meeting; San Diego, CA (USA); 11-14 Jun 1990)			
2	15:45144	*See* SAND–90-1963C			
CONF-900623–		(15. symposium on effects of radiation on materials; Nashville, TN (USA); 17-21 Jun 1990)			
12	15:46237	*See* PNL-SA–18229			
13	15:46231	*See* PNL-SA–17548			
14	15:44286	*See* PNL-SA–17517			
15	15:46234	*See* PNL-SA–17804			
CONF-9006252–		(OSA science of optical finishing workshop; Monterey, CA (USA); 10-12 Jun 1990)			
1-Rev.1	15:44812	*See* UCRL–102845-Rev.1			
CONF-9006253–		(ASHRAE annual meeting; St. Louis, MO (USA); 9-13 Jun 1990)			
1	15:44506	*See* LBL–27902			
CONF-9006254–		(Karolinska hospital symposium on disorders of HDL; Stockholm (Sweden); 6-8 Jun 1990)			
1	15:45526	*See* LBL–29240			
CONF-9006255–		(ISIAT '90; Tokyo (Japan); 4-8 Jun 1990)			
1	15:44638	*See* LBL–29034			
CONF-9006256–		(American astronomical society meeting; Albuquerque, NM (USA); 10-14 Jun 1990)			
1	15:45684	*See* UCRL–102955			
CONF-9006259–		(Fermilab III instabilities workshop; Batavia, IL (USA); 25-29 Jun 1990)			
1	15:45115	*See* BNL–44899			
2	15:45102	*See* BNL–44904			
CONF-9006260–		(4. Canadian supercomputing symposium; Montreal (Canada); 4-6 Jun 1990)			
1	15:46291	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016042	MF-405
CONF-900631–		(International conference on pollution prevention: clean technologies and clean products–the environmental challenge of the 1990's; Washington, DC (USA); 10-13 Jun 1990)			
2	15:44000	*See* WHC-SA–0818			
CONF-900643–		(IEEE international symposium on applications of ferroelectrics; Urbana, IL (USA); 6-8 Jun 1990)			
1	15:46317	*See* SAND–90-1551C			
CONF-900676–		(83. annual meeting and exhibition of the Air and Waste Management Association; Pittsburgh, PA (USA); 24-29 Jun 1990)			
10	15:45633	*See* UCRL-JC–103410			
11	15:43926	*See* PNL-SA–18010			
CONF-900679–		(1990 Health Physics Society meeting; Anaheim, CA (USA); 24-28 Jun 1990)			
6	15:46053	*See* PNL-SA–17693			

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CONF-900705–		(8. world hydrogen energy conference; Honolulu, HI (USA); 22-27 Jul 1990)			
5	15:46201	*See* BNL–44901			
CONF-9007106–		(Institute of nuclear materials management conference; Carnahan conference on security technology; Los Angeles, CA (USA); Lexington, KY (USA); 15-18 Jul 1990; 10 oct 1990)			
2	15:44017	*See* SAND–90-1660C			
40	15:44016	*See* LA-UR–90-2378			
46	15:44015	*See* LA-UR–90-2312			
47	15:43918	*See* LA-UR–90-2255			
50	15:44014	*See* LA-UR–90-2209			
51	15:44854	*See* LA-UR–90-2204			
55	15:44018	*See* UCRL–102705			
56	15:45185	*See* MLM–3646(OP)			
57	15:45186	*See* MLM–3651(OP)			
CONF-9007111–		(8. international conference on high-power particle beams; Novosibirsk (USSR); 2-5 Jul 1990)			
14	15:46221	*See* LBL–28167			
CONF-9007136–		(1990 summer workshop on nonlinear and chaotic phenomena in plasmas, solids, and fluids; Edmonton (Canada); 16-27 Jul 1990)			
2	15:46167	*See* UCRL-JC–104606			
CONF-9007138–		(Meeting on vertical displacement events and disruption generated runaway electrons; Garching (Germany, F.R.); 23-25 Jul 1990)			
1	15:46163	*See* SAND–90-1959C			
CONF-9007139–		(3. international workshop on positron and positronium chemistry; Milwaukee, WI (USA); 16-19 Jul 1990)			
1	15:44845	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015154	MF-401; MF-411
2	15:45732	*See* SAND–90-1442C			
CONF-9007140–		(Subcommittee on energy research and development committee on energy and natural resources; Washington, DC (USA); 25 Jul 1990)			
1	15:44421	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015165	MF-400
CONF-9007141–		(Workshop on heavy-ion collisions at energies near the Coulomb barrier; Daresbury (UK); 5-7 Jul 1990)			
1	15:45894	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015173	MF-413
2	15:45895	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015788	MF-413
CONF-9007142–		(9. international round table conference on nucleosides and nucleotides, and their biological applications; Uppsala (Sweden); 30 Jul 1990)			
1	15:44951	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015169	MF-408
CONF-9007143–		(ITER burn control meeting; Garching (Germany, F.R.); 9-13 Jul 1990)			
1	15:46137	*See* DOE/ER/52127–68			
CONF-9007145–		(SUR/FIN '90; Boston, MA (USA); 11 Jul 1990)			
1	15:44554	*See* EGG-M–90294			
CONF-9007146–		(SHARE (IBM user's group); New Orleans, LA (USA); 12 Jul 1990)			
1	15:46318	*See* SAND–90-2036C			
CONF-9007147–		(IUPAC symposium on macrommolecules; Montreal (Canada); 8-13 Jul 1990)			
1	15:44810	*See* SAND–90-0109C			
CONF-9007149–		(39. annual Denver x-ray conference; Steamboat Springs, CO (USA); 30 Jul - 3 aug 1990)			
2	15:44857	*See* SAND–90-1084C			
CONF-9007150–		(International biophysics congress satellite symposium; Whistler (Canada); 23-27 Jul 1990)			
1	15:45519	*See* BNL–44758			
CONF-9007155–		(15. international laser radar conference; Tomsk (USSR); 23 Jul 1990)			
1	15:45255	*See* ETDE-IT–90-13			
2	15:45466	*See* ETDE-IT–90-14			
3	15:45256	*See* ETDE-IT–90-15			

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CONF-9007155–		(Annual meeting of international union of pure and applied chemistry; Petten (Netherlands); 4-6 Jul 1990)			
1	15:45323	*See* PNL-SA–18293			
CONF-900723–		(27. IEEE annual international nuclear and space radiation effects conference; Reno, NV (USA); 16-20 Jul 1990)			
14	15:45181	*See* SAND–90-1924C			
15	15:45054	*See* SAND–90-1845C			
CONF-900726–		(International conference on polarization phenomena in nuclear physics; Paris (France); 9-13 Jul 1990)			
2	15:45844	*See* LBL–29136			
CONF-900738–		(8. American conference on crystal growth; Vail, CO (USA); 15-20 Jul 1990)			
3	15:44654	*See* SAND–90-2135C			
CONF-900739–		(4. Latin American workshop on plasma physics; Buenos Aires (Argentina); 16-27 Jul 1990)			
2	15:46143	*See* DOE/ET/51013–283			
CONF-900756–		(SPIE's international symposium on optical and optoelectronic applied science and engineering exhibit; San Diego, CA (USA); 8-13 Jul 1990)			
14	15:45202	*See* LA-UR–90-2320			
16	15:45542	*See* UCRL–102523			
20	15:45058	*See* UCRL-JC–102565			
21	15:45463	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015539	MF-402
22	15:45191	*See* LBL–29150			
23	15:43853	*See* EGG-M–90019			
24	15:45193	*See* SAND–89-3009C			
25	15:45196	*See* UCRL-JC–104478			
26	15:45206	*See* UCRL–102468			
27	15:45686	*See* UCRL-JC–104339			
28	15:45195	*See* UCRL-JC–104337			
30	15:44659	*See* UCRL-JC–104205			
31	15:46250	*See* UCRL-JC–104457			
32	15:46249	*See* UCRL-JC–104456			
33	15:46248	*See* UCRL-JC–104455			
34	15:45222	*See* MLM–3647(OP)			
35	15:44647	*See* PNL-SA–17876			
36	15:45192	*See* PNL-SA–18152			
CONF-900757–		(15. international conference on x-ray and inner-shell processes; Knoxville, TN (USA); 9-13 Jul 1990)			
3	15:46165	*See* UCRL-JC–103919			
4	15:45598	*See* PNL-SA–18193			
CONF-900766–		(1. biennial conference on low energy antiproton physics; Stockholm (Sweden); 2-6 Jul 1990)			
1	15:45084	*See* BNL–44953			
CONF-900777–		(Workshop on science at the KAON factory; Vancouver (Canada); 23-28 Jul 1990)			
1	15:45870	*See* LA-UR–90-2861			
CONF-900791–		(Review of progress in quantitative NDE; La Jolla, CA (USA); 15-20 Jul 1990)			
1	15:46288	NTIS, PC A02/MF A01 - OSTI		DE90016044	MF-405
CONF-900792–		(15. international pyrotechnics seminar; Boulder, CO (USA); 9-13 Jul 1990)			
9	15:45221	*See* MLM–3645(OP)			
11	15:45223	*See* MLM–3648(OP)			
12	15:45224	*See* MLM–3649(OP)			
13	15:44639	*See* MLM–3650(OP)			
CONF-900793–		(AAAI '90: 8. national conference on artificial intelligence; Boston, MA (USA); 17 Jul - 3 aug 1990)			
3	15:46312	*See* PNL-SA–18089			
CONF-900794–		(ASCE conference on environmental engineering; Washington, DC (USA); 9-11 Jul 1990)			
2	15:43968	*See* PNL-SA–17602			

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CONF-900801–		(25. intersociety energy conversion engineering conference; Reno, NV (USA); 12-17 Aug 1990)			
24	15:44168	*See* SERI/TP–254-3799			
25	15:44372	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015163	MF-220
CONF-900802–		(200. American Chemical Society national meeting; Washington, DC (USA); 26-31 Aug 1990)			
4	15:43958	*See* LA-UR–90-2566			
CONF-900809–		(21. DOE/NRC nuclear air cleaning conference; San Diego, CA (USA); 13-16 Aug 1990)			
1	15:43912	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015160	MF-525
CONF-9008109–		(International conference on environmental issues and management of waste in energy and minerals production; Secaucus, NJ (USA); 27-29 Aug 1990)			
1	15:44480	*See* UCRL-JC–103606			
CONF-9008125–		(Explomet conference; San Diego, CA (USA); 12-17 Aug 1990)			
2	15:45218	*See* SAND–90-0882C			
3	15:44649	*See* SAND–90-0883C			
CONF-9008128–		(SDIO/T/IS ultra shrot wavelength laser briefing; Washington, DC (USA); Aug 1990)			
1	15:45055	*See* SAND–90-1944C			
CONF-9008129–		(11. biennial conference on chemical education; Atlanta, GA (USA); 5-9 Aug 1990)			
1	15:45933	*See* LBL–29172			
2	15:45099	*See* LBL–29229			
CONF-9008132–		(DOE criticality alarm workshop; Los Alamos, NM (USA); 14-16 Aug 1990)			
1	15:45174	*See* RFP–4435			
CONF-9008133–		(4. Asia Pacific physics conference; Seoul (Republic of Korea); 13-17 Aug 1990)			
1	15:45958	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015799	MF-413
CONF-9008136–		(Workshop on radiation effects on materials in high radiation environments; Salt Lake City, UT (USA); 13-15 Aug 1990)			
1	15:44306	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016053	MF-414
CONF-9008137–		(12. international conference on raman spectroscopy; Columbia (S is not a valid Country Code.); 13 Aug 1990)			
1	15:44851	*See* ETDE-IT–90-16			
CONF-900814–		(7. ASTM-EURATOM symposium on reactor dosimetry; Strasbourg (France); 27-31 Aug 1990)			
5	15:45176	*See* SAND–89-2587C			
7	15:46203	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016020	MF-413
8	15:45180	*See* SAND–89-2284C			
9	15:46054	*See* SAND–90-0189C			
CONF-900822–		(25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990)			
6	15:45973	*See* BNL–44774			
CONF-900823–		(Annual meeting of the Geothermal Resources Council and international symposium on geothermal energy; Kailua Kona, HI (USA); 20-24 Aug 1990)			
11	15:44154	*See* LBL–28971			
12	15:44155	*See* LBL–29046			
CONF-900828–		(Summer national meeting of the American Institute of Chemical Engineers; San Diego, CA (USA); 19-22 Aug 1990)			
6	15:46289	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016032	MF-405; MF-406
CONF-900833–		(ACEEE summer study on energy efficiency in buildings; Pacific Grove, CA (USA); 26 Aug - 1 sep 1990)			
6	15:44502	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015158	MF-920

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-900846–		(International symposium to commemorate the 50th anniversary of discovery of transuranium elements; Washington, DC (USA); 26-31 Aug 1990)			
1	15:44636	*See* LA-UR–90-2567			
CONF-900853–		(Gasification and gas stream cleanup systems; Morgantown, WV (USA); 28-30 Aug 1990)			
1	15:43653	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015795	MF-109
CONF-900877–		(12. international congress for electron microscopy; Seattle, WA (USA); 12-18 Aug 1990)			
5	15:46062	*See* LBL–28788-Extd.Abst.			
CONF-900883–		(International conference and exhibition on computer applications to materials science and engineering: computer-aided innovation of new materials; Tokyo (Japan); 28-31 Aug 1990)			
1	15:44616	*See* BNL–44939			
CONF-9009102–		(2. international computational physics conference and Europhysics conference on computational physics; Amsterdam (Netherlands); 10-13 Sep 1990)			
1	15:45109	*See* SAND–90-1466C			
CONF-900912–		(8. international conference on atomic masses and fundamental constants; Jerusalem (Israel); 9-14 Sep 1990)			
1	15:45996	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016048	MF-411
CONF-9009164–		(2. international symposium on gas transfer at water surfaces; Minneapolis, MN (USA); 11-14 Sep 1990)			
1	15:44126	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015537	MF-225
CONF-900917–		(American Nuclear Society topical meeting on safety of non-commercial nuclear reactor research and irradiation facilities; Boise, ID (USA); 30 Sep - 3 oct 1990)			
11	15:44354	*See* SAND–90-0113C			
12-Rev.1	15:44360	*See* WHC-SA–0817-Rev.1			
13	15:44235	*See* SAND–90-0114C			
14	15:44320	*See* BNL–44836			
15	15:44322	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015605	MF-400
CONF-9009172–		(Close combat light simulations technology conference; Albuquerque, NM (USA); 17-20 Sep 1990)			
2	15:45220	*See* UCRL-JC–103603			
CONF-9009192–		(International symposium on discharges and electrical insulation in vacuum; Santa Fe, NM (USA); 17-20 Sep 1990)			
7	15:46220	*See* LA-UR–90-2322			
8	15:46240	*See* SAND–90-0910C			
9	15:44650	*See* SAND–90-1006C			
10	15:45136	*See* LBL–28703			
11	15:45139	*See* LBL–29244			
12	15:46241	*See* SAND–90-1002C			
CONF-9009200–		(1990 LINAC conference; Albuquerque, NM (USA); 10-14 Sep 1990)			
2	15:45142	*See* SAND–90-1268C			
3	15:45141	*See* SAND–90-1243C			
CONF-9009201–		(Radioluminescent technology conference; Annapolis, MD (USA); 25-26 Sep 1990)			
1	15:44134	*See* SAND–90-2130C			
2	15:44976	*See* SAND–90-2129C			
3	15:44061	*See* SAND–90-2120C			
4	15:44064	*See* KCP–613-4410			
CONF-9009219–		(1990 joint RELAP5 and TRAC-BWR international user seminar; Chicago, IL (USA); 17-21 Sep 1990)			
2	15:44323	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015792	MF-523
CONF-9009221–		(6. international symposium on gaseous dielectrics; Knoxville, TN (USA); 23-27 Sep 1990)			
2	15:45608	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016029	MF-220

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CONF-9009222–		(Lattice defects in insulating materials conference; Groningen (Netherlands); 3-7 Sep 1990)			
1	15:44692	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014454	MF-410
CONF-9009223–		(19. annual North American thermal analysis society conference; Boston, MA (USA); 23-26 Sep 1990)			
2	15:44794	*See* KCP–613-4326			
CONF-9009225–		(12. annual international computervision user conference; Nashville, TN (USA); 30 Sep - 3 oct 1990)			
1	15:44978	*See* UCRL-JC–104204			
CONF-9009226–		(Committee on safety of nuclear installations (CSNI); Santa Fe, NM (USA); 4-6 Sep 1990)			
1	15:46330	*See* LA-UR–90-2604			
CONF-9009227–		(2. Physical interpretations of relativity theory; London (UK); 3-8 Sep 1990)			
1	15:45876	*See* SLAC-PUB–5218			
CONF-9009228–		(Tough user's workshop; Berkeley, CA (USA); 13-14 Sep 1990)			
1	15:43993	*See* SAND–90-1071C			
CONF-9009229–		(SPIE, chemical, biochemical and environmental fiber sensor symposium; San Jose, CA (USA); 16-20 Sep 1990)			
1	15:44939	*See* SAND–90-0800C			
CONF-9009230–		(EPRI condenser technology conference; Boston, MA (USA); 18 Sep 1990)			
1	15:44193	*See* EGG-M–90263			
CONF-9009231–		(MARC finite element analysis users conference; Monterey, CA (USA); 20-21 Sep 1990)			
1	15:46313	*See* RFP–4419			
CONF-9009232–		(23. NEXUS conference; Orlando, FL (USA); 11-14 Sep 1990)			
2	15:46319	*See* SAND–90-2066C			
CONF-9009233–		(ENSOL '90; Santa Clara, CA (USA); 12 Sep 1990)			
1	15:44006	*See* FMPC–2204			
CONF-900924–		(9. international symposium on high energy spin-physics; Bonn (Germany, F.R.); 10-15 Sep 1990)			
1	15:45101	*See* BNL–44886			
CONF-900936–		(7. international conference on ion beam modification of materials; Knoxville, TN (USA); 9-14 Sep 1990)			
1	15:44620	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016038	MF-404
CONF-900953–		(8. biennial international symposium on gas flow and chemical lasers; Madrid (Spain); 10-14 Sep 1990)			
1	15:46219	*See* LA-UR–89-2875			
CONF-900958–		(7. annual international Pittsburgh coal conference; Pittsburgh, PA (USA); 10-14 Sep 1990)			
2	15:43654	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015794	MF-109
CONF-900970–		(International conference on Monte Carlo methods in neutron and photon transport; Budapest (Hungary); 25-28 Sep 1990)			
1	15:45893	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015156	MF-420; MF-413
2	15:46050	*See* UCRL–102786			
CONF-901008–		(Fall meeting of the Minerals, Metals and Materials Society on physical metallurgy and materials in conjunction with materials week and the material applications and services exposition; Detroit, MI (USA); 7-11 Oct 1990)			
1	15:44648	*See* RFP–4390			
CONF-901009–		(Japan international tribology conference; Nagoya (Japan); 29 Oct - 1 nov 1990)			
1	15:44621	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90007805	MF-373
2	15:44622	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009705	MF-373
3	15:44687	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012166	MF-373

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CONF-9010116–		(Polyurethanes '90 conference; Orlando, FL (USA); 1-4 Oct 1990)			
1	15:44789	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012782	MF-350
2	15:44504	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015157	MF-350
CONF-9010120–		(16. conference on severe local storms; Alta (Canada); 22-26 Oct 1990)			
1	15:45201	*See* LA-UR–90-2161			
CONF-9010121–		(13. national computer security conference; Washington, DC (USA); 1-4 Oct 1990)			
1	15:46305	*See* LA-UR–90-2042			
2	15:46306	*See* LA-UR–90-2082			
CONF-9010151–		(International topical meeting on the safety, status, and future of non-commercial reactors and irradiation facilities; Boise, ID (USA); 4 Oct 1990)			
1	15:44324	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014205	MF-400
CONF-9010153–		(Project management institute seminar/symposium; Clagary (Canada); 17 Oct 1990)			
1	15:43945	*See* FMPC–2202			
CONF-9010154–		(1. international hypersonic waverider symposium; College Park, MD (USA); Oct 1990)			
1	15:45757	*See* LA-UR–90-2437			
CONF-9010155–		(Human factors society conference; Orlando, FL (USA); 8-12 Oct 1990)			
1	15:45216	*See* LA-UR–90-2483			
2	15:44321	*See* BNL-NUREG–44849			
CONF-9010156–		(5. ASSP workshop on spectrum estimation and modeling; Rochester, NY (USA); 10-12 Oct 1990)			
1	15:45539	*See* LA-UR–90-2552			
CONF-9010158–		(9. IEEE/CHMT international electronics manufacturing technology symposium; Washington, DC (USA); 1-3 Oct 1990)			
1	15:46315	*See* SAND–90-0743C			
CONF-9010159–		(1990 American society of metals week materials weldability symposium; Detroit, MI (USA); 6-12 Oct 1990)			
1	15:44657	*See* UCRL-JC–104189			
CONF-9010167–		(CARTS-EUROPE '90 capacitor and resistor technology symposium; Bordeaux (France); 8-10 Oct 1990)			
1	15:45053	*See* SAND–90-1166C			
CONF-9010168–		(IERE workshop on GIS program; Toronto (Canada); 1-3 Oct 1990)			
1	15:44867	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015152	MF-407
CONF-9010169–		(1990 IEEE GaAs IC symposium; New Orleans, LA (USA); 7-10 Oct 1990)			
1	15:45056	*See* SAND–90-2048C			
CONF-901017–		(International conference and exhibition of the Instrument Society of America; New Orleans, LA (USA); 14-19 Oct 1990)			
2	15:46290	NTIS, PC A02/MF A01 - OSTI		DE90011711	MF-406
3	15:44503	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011651	MF-406
4	15:45229	*See* Y/DW–923			
1-Rev.1	15:46243	*See* UCRL–101945-Rev.1			
1-Rev.2	15:46244	*See* UCRL–101945-Rev.2			
CONF-9010170–		(International symposium on nonlinear optical materials; El Paso, TX (USA); 28 Oct - 2 nov 1990)			
1	15:44811	*See* SAND–90-2058C			
CONF-9010173–		(7. DOE-PETC/AIST-NEDO joint technical meeting; New Orleans, LA (USA); 8-12 Oct 1990)			
1	15:43694	*See* SAND–90-2145C			
CONF-901024–		(2. international conference on containment design and operation; Toronto (Canada); 14-17 Oct 1990)			
1	15:44355	*See* SAND–90-1366C			
2	15:44353	*See* SAND–89-3105C			
3	15:44352	*See* SAND–89-3104C			
4	15:44350	*See* SAND–89-3010C			

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CONF-901024–					
5	15:44351	*See* SAND–89-3096C			
CONF-901025–		(13. international conference on plasma physics and controlled nuclear fusion research; Washington, DC (USA); 1-6 Oct 1990)			
1	15:46139	*See* DOE/ER/53223–129			
2	15:46154	*See* LA-UR–90-2864			
3	15:46155	*See* LA-UR–90-2868			
CONF-901026–		(ASME/VGE international power plants conference; Boston, MA (USA); 21-25 Oct 1990)			
1	15:44623	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90010497	MF-504
CONF-901034–		(ASME/IEEE joint power generation conference; Boston, MA (USA); 21-25 Oct 1990)			
1	15:44624	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016039	MF-504
CONF-901036–		(4. international conference on environmental contamination; Barcelona (Spain); 1-4 Oct 1990)			
1	15:44570	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015159	MF-402
CONF-901055–		(Association for the Development of Computer-based Instruction Systems (ADCIS) meeting; San Diego, CA (USA); 29 Oct - 1 nov 1990)			
1	15:46304	*See* LA-UR–90-776			
CONF-901058–		(4. incipient failure detection conference: predictive maintenance for the 90's; Philadelphia, PA (USA); 15-17 Oct 1990)			
1	15:45199	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012595	MF-406
CONF-901062–		(1. joint IEEE/PES international power meeting; New Delhi (India); 28 Oct - 1 nov 1990)			
1	15:45029	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009704	MF-364
CONF-901070–		(Sensors conference; New Orleans, LA (USA); Oct 1990)			
1	15:45187	*See* EGG-M–90070			
CONF-901071–		(Joint STLE-ASME tribology conference; Toronto (Canada); 7-10 Oct 1990)			
1	15:44625	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010091	MF-373
2	15:44688	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010088	MF-373
3	15:44689	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009706	MF-373
5	15:44626	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012943	MF-373
6	15:44979	*See* UCRL-JC–104362			
7	15:44690	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015790	MF-373
CONF-901073–		(178. meeting of Electrochemical Society, Inc.; Seattle, WA (USA); 14-19 Oct 1990)			
2	15:44691	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011179	MF-404
3	15:46061	*See* LA-UR–90-1500			
4	15:46060	*See* LA-UR–90-1499			
5	15:44637	*See* LBL–28954			
6	15:44488	*See* LA-UR–90-2538			
CONF-901074–		(International telemetering conference; Las Vegas, NV (USA); 29 Oct 1990)			
1	15:46316	*See* SAND–90-0985C			
2	15:45205	*See* SAND–90-0986C			
CONF-901075–		(Spectrum '90; Knoxville, TN (USA); 3-5 Oct 1990)			
1	15:43991	*See* RFP–4414			
2	15:43922	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90011370	MF-820
3	15:43927	*See* WHC-SA–0815			
CONF-901088–		(11. international conference on chemical vapor deposition; Seattle, WA (USA); 14-19 Oct 1990)			
1	15:44878	*See* SAND–90-0091C			
2	15:44982	*See* SAND–90-0086C			
3	15:45030	NTIS, PC A03/MF A01 - OSTI		DE90013380	MF-364
CONF-901089–		(Visualization '90; San Francisco, CA (USA); 23-26 Oct 1990)			
1	15:44958	*See* SAND–90-1383C			
2	15:46307	*See* LA-UR–90-2614			
CONF-901090–		(2. international machinery monitoring and diagnostic conference; Los Angeles, CA (USA); 22-25 Oct 1990)			
1	15:44287	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90011168	MF-520

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CONF-901092–		(Institute of nuclear materials management conference; Carnahan conference on security technology; Los Angeles, CA (USA); Lexington, KY (USA); 15-18 Jul 1990; 10 oct 1990)			
2	15:44017	*See* SAND–90-1660C			
3	15:44972	*See* SAND–89-3100C			
CONF-901095–		(ASM fall meeting; Detroit, MI (USA); 6-12 Oct 1990)			
1	15:44651	*See* SAND–90-1335C			
2	15:44653	*See* SAND–90-1694C			
3	15:44652	*See* SAND–90-1693C			
4	15:44635	*See* LA-UR–90-2516			
5	15:44658	*See* UCRL-JC–104190			
CONF-901099–		(7. American Physical Society topical conference on atomic processes in plasmas; Gaithersburg, MD (USA); 2 Oct 1990)			
1	15:46224	*See* ORNL/TM–11542			
CRC–					
568	15:44594	*See* AD-A–221321/3/XAB			
CRN-CPR–					
89-01	15:44790	NTIS (US Sales Only), PC A07/MF A01		DE90514621	
89-04	15:45031	NTIS (US Sales Only), PC A07/MF A01		DE90514620	
CRN-PN–					
89-23	15:46292	NTIS (US Sales Only), PC A06/MF A01		DE90514622	
CRN/PN–					
89-17	15:45976	NTIS (US Sales Only), PC A06/MF A01		DE90514623	
CSCHE–					
CE03090-Vol.2	15:44847	Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, ON. CAN K1G 3Y6. Prices: PRICES UPON REQUEST			
CE0389-Vol.1	15:44846	Canadian Society for Chemical Engineering, 1785 Alta Vista Drive, Ottawa, ON, CAN K1G 3Y6. Prices: PRICES UPON REQUEST			
CSNSM-T–					
89-51	15:45665	NTIS (US Sales Only), PC A11/MF A01		DE90514609	
CUED/C-MATS/TR–					
168	15:44808	*See* PB–90-223868/XAB			
CUED/C/MATS/TR–					
164	15:44807	*See* PB–90-223819/XAB			
CUED/D-SOILS/TR–					
229	15:45657	*See* PB–90-223926/XAB			
CUED/D-STRUCT–					
129	15:43848	*See* PB–90-223793/XAB			
DNE-R–					
16	15:44247	Available from H.M. Stationery Office, price Pound 7.00			
DOD-D–					
3020.35	15:45217	*See* PB–90-228511/XAB			
5210.63	15:44346	*See* PB–90-228206/XAB			
DOE/BC/10647–					
20	15:43786	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000253	PC-122
DOE/BC/14000–					
3	15:43787	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000255	PC-122
4	15:43788	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000256	PC-122
5	15:43789	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000257	PC-122
DOE/BC/14126–					
16	15:43790	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000249	PC-122
20	15:43791	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000236	PC-122
22	15:43792	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000250	PC-122
25	15:43793	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000251	PC-122
26	15:43794	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000259	PC-122
DOE/BC/14200–					
T1	15:43795	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016196	MF-122
DOE/CE/15437–					
T4	15:44552	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015381	MF-245
DOE/CE/27474–					
T1	15:44191	NTIS, PC A05/MF A01; OSTI; Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.; GPO Dep.	E 1.99:	DE90014933	MF-224

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DOE/DP/10782–					
1	15:45556	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016098	MF-706
DOE/DP/40200–					
130	15:46205	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015784	MF-712
DOE/EH–					
0090-Vol.1	15:44387	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014833	MF-630
0090-Vol.2	15:44388	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014834	MF-630
DOE/EH/89027–					
H1P	15:45244	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014848	PC-600; PC-601; PC-603
DOE/EIA–					
0226(90/05)	15:44471	NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90016114	MF-950
0340(89)/2	15:43830	NTIS, PC A25/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90016012	MF-950
0380(90/05)	15:43831	NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90015522	MF-950
0520(90/07)	15:43832	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90016010	MF-950
0523(89/4Q)	15:43784	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90016014	MF-950
0533	15:44449	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90015858	MF-950
DOE/EM–					
0004P	15:43929	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016658	MF-900
DOE/ER–					
0464P	15:45085	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014828	MF-414
0466P	15:46326	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014835	MF-400
DOE/ER/00038–					
3304	15:44947	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016220	MF-401
DOE/ER/13065–					
634	15:45782	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015382	MF-413
DOE/ER/13491–					
424	15:45086	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015651	MF-411
DOE/ER/13530–					
T1	15:45712	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016117	MF-403
DOE/ER/13552–					
5	15:44848	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015404	MF-401
DOE/ER/13560–					
T1	15:44791	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016209	MF-404
DOE/ER/13564–					
8	15:44868	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015654	MF-401
DOE/ER/13569–					
5	15:44869	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015826	MF-401
DOE/ER/13617–					
4	15:44870	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015387	MF-401
DOE/ER/13715–					
2	15:44075	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016126	MF-408
DOE/ER/13833–					
7	15:44849	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015068	MF-401
DOE/ER/13924–					
3	15:44076	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015934	MF-401
DOE/ER/14039–					
T1	15:44938	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016095	MF-401
DOE/ER/14071–					
1	15:45522	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015818	MF-408
DOE/ER/25006–					
4	15:46293	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016127	MF-405
5	15:46294	NTIS, PC A03/MF A01 - OSTI		DE90016128	MF-405
DOE/ER/25013–					
5	15:46295	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015655	MF-405
DOE/ER/25019–					
18	15:46091	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016118	MF-405
19	15:45523	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016119	MF-408
DOE/ER/25026–					
36	15:46296	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015875	MF-405
37	15:46297	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015874	MF-405
DOE/ER/25060–					
1	15:46298	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015118	MF-400
DOE/ER/40322–					
102	15:45999	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016202	MF-413
DOE/ER/40387–					
4	15:46206	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015733	MF-420
DOE/ER/40415–					
15	15:45897	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015852	MF-413

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/40418–					
3	15:45959	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016501	MF-413
DOE/ER/40427–					
05-N90	15:46003	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016121	MF-413
DOE/ER/40537–					
1	15:45898	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016120	MF-413
DOE/ER/45056–					
9	15:44792	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015853	MF-404
DOE/ER/45253–					
5	15:44627	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015935	MF-404; MF-410
DOE/ER/45297–					
13	15:46080	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015515	MF-410
DOE/ER/45298–					
6	15:44871	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015824	MF-401
DOE/ER/51124–					
T1	15:46136	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016096	MF-420
DOE/ER/52127–					
67	15:46207	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015660	MF-427
68	15:46137	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015659	MF-427
70	15:46208	NTIS, PC A03/MF A01; OSTI; INIS		DE90015658	MF-427
DOE/ER/53203–					
4	15:46138	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015661	MF-420
DOE/ER/53223–					
129	15:46139	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90013294	MF-420
DOE/ER/53242–					
4	15:46140	NTIS, PC A04/MF A01; OSTI; INIS		DE90016122	MF-426
DOE/ER/53243–					
3	15:46209	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016123	MF-420
DOE/ER/53252–					
20	15:46141	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015856	MF-427
DOE/ER/53263–					
9	15:46142	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015732	MF-420
DOE/ER/60397–					
T5	15:45245	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015648	MF-402
DOE/ER/60437–					
5	15:45538	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015650	MF-410
DOE/ER/60485–					
3	15:45246	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015528	MF-402
DOE/ER/60514–					
4	15:44872	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015862	MF-401
DOE/ER/60617–					
4	15:45609	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015861	MF-408
DOE/ER/60634–					
T3	15:45586	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015380	MF-408
DOE/ER/60654–					
3	15:45587	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016203	MF-407
DOE/ER/60657–					
3	15:45610	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016124	MF-407
DOE/ER/60845–					
1	15:45464	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016191	MF-402
DOE/ER/60864–					
1	15:45638	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015642	MF-407
DOE/ER/60870–					
1	15:45549	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016192	MF-401
DOE/ER/60932–					
1	15:45335	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015814	MF-402
DOE/ER/75498–					
1	15:44422	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015423	MF-400
DOE/ET/10815–					
136	15:44486	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015859	MF-112
137	15:44192	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015863	MF-112
DOE/ET/15601–					
38	15:44487	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015403	MF-112
DOE/ET/51013–					
283	15:46143	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015825	MF-426
284	15:46144	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015386	MF-420
DOE/FE/00016–					
T163	15:43720	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015511	MF-116
T164	15:43721	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015510	MF-116
T165	15:43722	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015509	MF-116

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
T166	15:43723	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015508	MF-116
T171	15:43724	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015503	MF-116
T172	15:43725	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015502	MF-116
T173	15:43726	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015501	MF-116
DOE/FE/61811–					
T4	15:43764	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015687	MF-101
T5	15:43765	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015688	MF-101
T6	15:43766	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015689	MF-101
T7	15:43767	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015690	MF-101
T8	15:43768	Resource Systems Institute, East-West Center, Honolulu, Hawaii 96848			ND-101
DOE/ID–					
10253	15:43932	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015473	MF-900
10273	15:43933	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015467	MF-721
DOE/ID/12612–					
1	15:44158	NTIS, PC A04/MF A01 - OSTI		DE90015426	MF-253
DOE/ID/12793–					
1	15:44553	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015524	MF-310
DOE/IE–					
0018	15:44472	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016004	MF-900
DOE/MA–					
0409	15:46266	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016008	MF-900
DOE/MC/21136–					
24	15:43796	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000254	PC-122
DOE/MC/23075–					
2865	15:43656	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016198	MF-109
DOE/MC/23293–					
2856	15:43657	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009673	MF-109
DOE/MC/24116–					
2867	15:43658	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016301	MF-109
DOE/MC/24268–					
T3	15:43659	NTIS, PC A05/MF A01 - OSTI		DE90015079	MF-109
DOE/NE/37963–					
12	15:44628	NTIS, PC A13/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016130	MF-504
DOE/NE/37969–					
T1	15:44964	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015777	MF-520
DOE/NV/10630–					
5	15:45228	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016133	MF-702
DOE/OR/21389–					
26	15:44571	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015073	MF-247
27	15:44065	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015062	MF-247
28	15:44071	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015063	MF-247
DOE/OR/21390–					
27	15:44066	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015071	MF-247
28	15:44067	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015072	MF-247
DOE/PC/79915–					
T9	15:43756	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015372	MF-103
DOE/PC/79928–					
T10	15:43660	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015142	MF-108
DOE/PC/80518–					
T13	15:43661	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015645	MF-115
T14	15:43662	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015646	MF-115
T15	15:43663	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015647	MF-115
DOE/PC/88853–					
T2-App.	15:43651	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016411	MF-102
DOE/PC/88929–					
T5	15:43757	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015144	MF-103
DOE/PC/90529–					
T3	15:43664	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015669	PC-109
DOE/PC/90533–					
10	15:43665	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015530	MF-108
11	15:43666	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015531	MF-108
12	15:43667	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015665	MF-108
DOE/PC/90534–					
15	15:43696	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015220	PC-115
DOE/PC/90958–					
T12	15:43727	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015668	PC-114
DOE/PE–					
90014954	15:44601	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014954	MF-920
DOE/RL–					
88-20-Suppl.1	15:43934	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015847	MF-512

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/RW–					
0051P-Rev.1	15:43935	OSTI (Free of Charge); INIS		TI90016005	MF-800
DOE/S–					
0077P	15:44005	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016002	MF-902
DOE/SR/15170–					
3	15:43706	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015766	MF-702
DRES-SM–					
1305	15:45212	*See* AD-A–221144/9/XAB			
DRES-SR–					
512	15:45233	*See* AD-A–221100/1/XAB			
531	15:45234	*See* AD-A–221101/9/XAB			
537	15:45235	*See* AD-A–221117/5/XAB			
DTRC–					
90/009	15:44523	*See* AD-A–221088/8/XAB			
DTRC/PAS–					
90/22	15:46271	*See* AD-A–221071/4/XAB			
EC/WSC–					
EN36-418/1988-6	15:44095	PC Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
EN36-418/1988-8	15:44096	PC Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
ECAO-CIN–					
443	15:45613	*See* PB–90-215054/XAB			
EEA–					
89-05127	15:43809	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
EGG–					
10617-5048	15:45713	NTIS, PC A03/MF A01 - OSTI		DE90012579	MF-700
2576	15:44342	*See* NUREG/CR–5448			
2583	15:44325	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015419	MF-520
2593	15:44343	*See* NUREG/CR–5528			
2612	15:45247	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014882	PC-510
EGG-BNCT–					
8777-Vol.4-No.4	15:45588	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015468	MF-507
8777-Vol.4-No.5	15:45589	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015469	MF-507
EGG-EAST–					
8700	15:44326	NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015413	MF-523
EGG-ESQ–					
8888	15:44965	NTIS, PC A11/MF A01 - OSTI		DE90015820	MF-500
EGG-M–					
89481	15:44572	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015472	MF-310
89498	15:44077	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015465	MF-246
90019	15:43853	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015464	MF-122
90070	15:45187	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90009641	MF-310
90263	15:44193	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015412	MF-220
90294	15:44554	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015463	
EGG-ME–					
9068	15:44966	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015471	MF-506
EGG-PRP–					
9058	15:46210	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015422	MF-423
EGG-SCM–					
7684	15:44629	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015470	
EGG-WM–					
8949	15:43936	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015420	MF-510
EML–					
522	15:45248	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014872	MF-402

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EML–					
524	15:45249	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014873	MF-402
527	15:45250	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014874	MF-402
528	15:45251	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014875	MF-402
EMR–					
BT31-2-1991-III-13	15:44385	PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $20.00; OTHER COUNTRIES: $24.00 CAN; MF $10 CAN			
EMR/RE–					
M91-7/16-1988E	15:44164	PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
EMR/V/CRE–					
CE02911	15:44092	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: PRICES UPON REQUEST			
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89-15	15:43937	NTIS (US Sales Only), PC A04/MF A01		DE90514467	
89-16	15:43938	NTIS (US Sales Only), PC A03/MF A01		DE90514468	
89-17	15:43807	NTIS (US Sales Only), PC A04/MF A01		DE90514469	
89-18	15:43939	NTIS (US Sales Only), PC A04/MF A01		DE90514470	
89-19	15:43940	NTIS (US Sales Only), PC A03/MF A01		DE90514471	
89-20	15:43941	NTIS (US Sales Only), PC A05/MF A01		DE90514472	
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89-23	15:44242	NTIS (US Sales Only), PC A03/MF A01		DE90514474	
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89-05	15:44130	NTIS (US Sales Only), PC A04/MF A01		DE90514466	
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89-09	15:46129	NTIS (US Sales Only), PC A03/MF A01		DE90514476	
89-11	15:46145	NTIS (US Sales Only), PC A03/MF A01		DE90706132	
89-12	15:46130	NTIS (US Sales Only), PC A03/MF A01		DE90514479	
89-20	15:46042	NTIS (US Sales Only), PC A02/MF A01		DE90514504	
89-24	15:46214	NTIS (US Sales Only), PC A03/MF A01		DE90514480	
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89-27	15:45156	NTIS (US Sales Only), PC A03/MF A01		DE90514494	
ENEA-RT-SAG–					
89-05	15:45590	NTIS (US Sales Only), PC A03/MF A01		DE90514500	
ENEA-RT-TIB–					
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89-27	15:45033	NTIS (US Sales Only), PC A03/MF A01		DE90514416	
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89-31	15:44026	NTIS (US Sales Only), PC A02/MF A01		DE90514482	
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89-49	15:46132	NTIS (US Sales Only), PC A03/MF A01		DE90514532	
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450/4-90/006A	15:45310	*See* PB–90-235961/XAB			
450/4-90/008	15:45296	*See* PB–90-231358/XAB			
450/4-90/008B	15:45297	*See* PB–90-231374/XAB			
520/1-90/009	15:45340	*See* PB–90-227950/XAB			

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600/3-90/050	15:43713	*See* PB–90-235086/XAB			
600/9-90/030	15:45308	*See* PB–90-235862/XAB			
600/D-90/024	15:44210	*See* PB–90-220807/XAB			
600/D-90/029	15:45281	*See* PB–90-221870/XAB			
600/D-90/034	15:45284	*See* PB–90-221912/XAB			
600/D-90/035	15:45285	*See* PB–90-221920/XAB			
600/D-90/042	15:45616	*See* PB–90-221748/XAB			
600/J-86/524	15:45622	*See* PB–90-232133/XAB			
600/J-88/521	15:45593	*See* PB–90-232257/XAB			
600/J-88/522	15:45624	*See* PB–90-232265/XAB			
600/J-89/361	15:45614	*See* PB–90-215989/XAB			
EPA/AA/CTAB–					
90/03	15:44533	*See* PB–90-235425/XAB			
EPA/ROD/R–					
04-89/053	15:45470	*See* PB–90-186487/XAB			
05-90/119	15:45501	*See* PB–90-235904/XAB			
05-90/120	15:45500	*See* PB–90-235896/XAB			
10-90/022	15:45499	*See* PB–90-235870/XAB			
EPRI-CU–					
6789	15:44474	Research Reports Center, Box 50490, Palo Alto, CA 94303			
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8902	15:45488	*See* PB–90-229832/XAB			
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90-03387	15:43797	PC Dept. of Industry, Science and Technology (ISTC), Library (CLIB), 235 Queen St., Ottawa, ON, CAN K1A 0H5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
ERL–					
88-62(TR)	15:43854	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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90-04	15:44850	NTIS (US Sales Only), PC A03/MF A01		DE90514458	
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90-07	15:44131	NTIS (US Sales Only), PC A02/MF A01		DE90514461	
90-09	15:44328	NTIS (US Sales Only), PC A03/MF A01		DE90514463	
90-10	15:45899	NTIS (US Sales Only), PC A02/MF A01		DE90514485	
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90-12	15:45254	NTIS (US Sales Only), PC A02		DE90514487	
90-13	15:45255	NTIS (US Sales Only), PC A02/MF A01		DE90514488	
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90-16	15:44851	NTIS (US Sales Only), PC A02/MF A01		DE90514491	
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90-45	15:44330	NTIS (US Sales Only), PC A03/MF A01		DE90514520	
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90-49	15:43909	NTIS (US Sales Only), PC A02/MF A01		DE90514524	
90-50	15:44027	NTIS (US Sales Only), PC A03/MF A01		DE90514525	
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90-56	15:43944	NTIS (US Sales Only), PC A03/MF A01		DE90514530	
90-57	15:44484	NTIS (US Sales Only), PC A02/MF A01		DE90514431	

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90-59	15:43916	NTIS (US Sales Only), PC A03		DE90514533	
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11290	15:44151	NTIS (US Sales Only), PC A22/MF A01			
11662-EN	15:43702	Commission of the European Communities, Luxembourg			
11717	15:44575	NTIS (US Sales Only), PC A12/MF A01			
12061	15:44630	NTIS (US Sales Only), PC A04/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg; Price: ECU 6.25		TI90016083	
12061-EN	15:43668	Commission of the European Communities, Luxembourg			
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12440	15:44088	NTIS (US Sales Only), PC A03/MF A01; OSTI; Office for Official Publications of the European Communities, 2, rue Mercier, L-2985 Luxembourg		TI90016065	
12479	15:43679	Elsevier Science Publishers, London (UK)			
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1373	15:46093	NTIS (US Sales Only), PC A03/MF A01			
1374	15:46150	NTIS (US Sales Only), PC A03/MF A01			
FERIC–					
TP10081E	15:44525	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
FERMILAB-PUB–					
89/262-A	15:45672	*See* N–90-22426			
FL-TR–					
90-0092	15:44140	*See* AD-A–220967/4/XAB			
FMPC–					
2202	15:43945	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014469	MF-702
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1671	15:45118	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014881	PC-406
1672	15:45119	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014879	PC-414
1673	15:45157	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014878	PC-405
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90/146-E	15:45788	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015624	MF-414
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20787-2.3	15:44643	*See* PB–90-233495/XAB			
FP–					
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286	15:45718	NTIS (US Sales Only), PC A09/MF A01		DE90514697	
FRNC-R–					
240	15:44150	NTIS (US Sales Only), PC A05/MF A01		DE90514541	
FRNC-TH–					
3598	15:44873	NTIS (US Sales Only), PC A06/MF A01		DE90514535	
3599	15:43892	NTIS (US Sales Only), PC A10/MF A01		DE90514555	
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641	15:45301	*See* PB–90-233180/XAB			
GA-A–					
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20000	15:46152	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014884	PC-427
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90-2FS	15:44100	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-33	15:45147	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-34	15:44577	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-37	15:45044	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-47	15:44331	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-60FS	15:44262	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-61FS	15:44332	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
90-93	15:44125	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
9044	15:43840	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20877 (USA)			
GC-TR–					
89-1658	15:44777	*See* AD-A–221334/6/XAB			
GCR–					
90-03384	15:43899	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
GL-TR–					
89-0319	15:45240	*See* AD-A–221752/9/XAB			
90-0097	15:45706	*See* AD-A–221068/0/XAB			
90-0105	15:45709	*See* AD-A–221719/8/XAB			
90-0125	15:45710	*See* AD-A–221801/4/XAB			
GRI–					
82/7005	15:43689	*See* PB–89-166136			
83/7005	15:43690	*See* PB–89-166144			
85/7007	15:43691	*See* PB–89-166151			
87/0337	15:43692	*See* PB–89-166177			
90/0120	15:44489	*See* LBL–27025-Rev.			
GRS-A–					
1441	15:43908	*See* BMU–1989-240			
1615	15:44319	*See* BMU–1990-252			
GRS-F–					
183	15:44333	NTIS (US Sales Only), PC A04/MF A01		DE90517360	
GSC–					
P88-20	15:45642	PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $8.25 CAN; MF $10 CAN			
GSF–					
16/89	15:43952	NTIS (US Sales Only), PC A10/MF A01		DE90517426	
GSF-BPT–					
2/89	15:45259	NTIS (US Sales Only), PC A07/MF A01		DE90517557	
GSF-TL–					
28/89	15:43952	*See* GSF–16/89			
GSI–					
89-10	15:45081	NTIS (US Sales Only), PC A15/MF A01		DE90517241	
90-1	15:45900	NTIS (US Sales Only), PC A19/MF A01		DE90517427	
HDL-TL–					
90-2	15:45636	*See* AD-A–221552/3/XAB			
HIFAN–					
440	15:46221	*See* LBL–28167			
HQ–					
90-03608	15:44476	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
IAEA-CN–					
53	15:46139	*See* DOE/ER/53223–129			
IAEA-R–					
4539-F	15:44631	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90636567	
IAEA-TECDOC–					
529	15:44290	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE90637030	
541	15:44263	NTIS (US Sales Only), PC A15/MF A01; OSTI; INIS		DE90637324	
549	15:44303	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE90637043	
554	15:45612	NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS		DE90636758	
IAERU–					
8904	15:46057	NTIS (US Sales Only), PC A05/MF A01		DE90513828	
IC–					
89/378	15:46094	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635649	
90/24	15:46095	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635650	
90/28	15:46096	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635651	
90/30	15:46097	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635652	
90/47	15:46098	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635653	
90/50	15:46081	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636257	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90/58	15:46082	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636258	
90/62	15:46099	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635673	
90/67	15:45812	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636271	
90/69	15:45851	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635690	
90/71	15:45852	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635691	
90/72	15:46100	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635654	
90/74	15:45813	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636310	
90/78	15:45814	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636272	
90/80	15:46101	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635655	
90/81	15:45853	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635692	
90/82	15:46102	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635656	
90/85	15:46004	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636357	
90/86	15:46103	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635657	
90/87	15:46104	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90635663	
90/89	15:46105	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635658	
90/90	15:45854	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635693	
90/94	15:45815	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636273	
IFP–					
37-059	15:43808	NTIS (US Sales Only), PC A12/MF A01		DE90514536	
37-310	15:44089	NTIS (US Sales Only), PC A07/MF A01		DE90514537	
INDC(UK)–					
044/LN	15:46036	*See* UKNDC(89)-P–116			
INIS-XN–					
212	15:44606	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90627084	
246	15:44214	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE90637055	
247	15:44277	NTIS (US Sales Only), PC A10/MF A01; OSTI; INIS		DE90637339	
248	15:44007	NTIS (US Sales Only), PC A06/MF A01; OSTI; INIS		DE90636797	
253	15:46051	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636828	
INIS-mf–					
11595	15:44020	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90615126	
11596	15:44021	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90615120	
11597	15:44028	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90615121	
11599	15:44022	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90615122	
12090	15:45524	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90706124	
12092	15:45550	NTIS (US Sales Only), PC A06/MF A01 - OSTI		DE90706125	
12093	15:45547	NTIS (US Sales Only), PC A04/MF A01 - OSTI		DE90706126	
12094	15:45525	OSTI		DE90706127	
12103	15:45551	NTIS (US Sales Only), PC A06/MF A01 - OSTI		DE90706128	
12104	15:45552	NTIS (US Sales Only), PC A04/MF A01 - OSTI		DE90706129	
12106	15:45553	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90706130	
12684	15:45575	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636777	
12685	15:45576	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636778	
12686	15:45577	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636779	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
INIS-mf–					
12687	15:45578	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636780	
12688	15:45579	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636781	
12689	15:45580	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636782	
INS–					
811	15:45984	NTIS (US Sales Only), PC A02/MF A01		DE90513764	
812	15:45855	NTIS (US Sales Only), PC A03/MF A01		DE90513765	
814	15:45856	NTIS (US Sales Only), PC A03/MF A01		DE90513782	
815	15:46005	NTIS (US Sales Only), PC A03/MF A01		DE90513783	
817	15:45125	NTIS (US Sales Only), PC A02/MF A01		DE90513784	
INS-T–					
491	15:44852	NTIS (US Sales Only), PC A03/MF A01		DE90513785	
494	15:45126	NTIS (US Sales Only), PC A04/MF A01		DE90513786	
495	15:45161	NTIS (US Sales Only), PC A03/MF A01		DE90513787	
IOM-TM–					
90-01	15:43779	Institute of Occupational Medicine, Edinburgh (UK)			
90-02	15:43780	Institute of Occupational Medicine, Edinburgh (UK)			
90-03	15:43781	Institute of Occupational Medicine, Edinburgh (UK)			
IPNO-AGOR–					
01-89	15:46300	NTIS (US Sales Only), PC A03/MF A01		DE90514636	
IPNO-DRE–					
89-11	15:45789	NTIS (US Sales Only), PC A02/MF A01		DE90514627	
89-12	15:46006	NTIS (US Sales Only), PC A03/MF A01		DE90514628	
89-13	15:46058	NTIS (US Sales Only), PC A02/MF A01		DE90514629	
89-14	15:45790	NTIS (US Sales Only), PC A03/MF A01		DE90514626	
89-22	15:45960	NTIS (US Sales Only), PC A03/MF A01		DE90514637	
89-27	15:45961	NTIS (US Sales Only), PC A03/MF A01		DE90514638	
89-29	15:45962	NTIS (US Sales Only), PC A03/MF A01		DE90514722	
IPNO-T–					
89-06	15:45162	NTIS (US Sales Only), PC A09/MF A01		DE90514632	
IPNO-TH–					
88-4	15:46007	NTIS (US Sales Only), PC A02/MF A01		DE90514630	
IPSM–					
53	15:46052	Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ. (Price Pound 16.50)			
IREQ–					
714U628	15:45045	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
IS-T–					
1483	15:44793	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015416	MF-401
ISI-B–					
2-90	15:45276	NTIS (US Sales Only), PC A11/MF A01		DE90517429	
ISTC–					
90-00820	15:44373	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
JA–					
6324	15:44999	*See* AD-A–221038/3/XAB			
6405	15:45006	*See* AD-A–221418/7/XAB			
JAERI-M–					
90-014	15:44632	NTIS (US Sales Only), PC A04/MF A01		DE90513710	
90-015	15:44853	NTIS (US Sales Only), PC A07/MF A01		DE90513763	
90-016	15:43917	NTIS (US Sales Only), PC A04/MF A01		DE90513754	
90-018	15:44952	NTIS (US Sales Only), PC A05/MF A01		DE90513709	
90-026	15:44633	NTIS (US Sales Only), PC A03/MF A01		DE90513608	
90-033	15:44241	NTIS (US Sales Only), PC A03/MF A01		DE90513794	
90-034	15:44310	NTIS (US Sales Only), PC A06/MF A01		DE90513755	
90-035	15:44334	NTIS (US Sales Only), PC A08/MF A01		DE90513743	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-037	15:44634	NTIS (US Sales Only), PC A03/MF A01		DE90513744	
90-040	15:44254	NTIS (US Sales Only), PC A07/MF A01		DE90513745	
90-041	15:46048	NTIS (US Sales Only), PC A03/MF A01		DE90513756	
90-042	15:44311	NTIS (US Sales Only), PC A04/MF A01		DE90513746	
90-043	15:44230	NTIS (US Sales Only), PC A05/MF A01		DE90513757	
90-044	15:44231	NTIS (US Sales Only), PC A08/MF A01		DE90513758	
90-046	15:44335	NTIS (US Sales Only), PC A06/MF A01		DE90513747	
90-047	15:44232	NTIS (US Sales Only), PC A03/MF A01		DE90513795	
90-049	15:45164	NTIS (US Sales Only), PC A03/MF A01		DE90513759	
90-050	15:44336	NTIS (US Sales Only), PC A06/MF A01		DE90513760	
90-051	15:44337	NTIS (US Sales Only), PC A12/MF A01		DE90513796	
90-052	15:44312	NTIS (US Sales Only), PC A04/MF A01		DE90513797	
90-053	15:44338	NTIS (US Sales Only), PC A03/MF A01		DE90513748	
90-054	15:44948	NTIS (US Sales Only), PC A04/MF A01		DE90513708	
90-055	15:44339	NTIS (US Sales Only), PC A11/MF A01		DE90513798	
90-056	15:46217	NTIS (US Sales Only), PC A03/MF A01		DE90513799	
90-057	15:44981	NTIS (US Sales Only), PC A03/MF A01		DE90513761	
90-058	15:44278	NTIS (US Sales Only), PC A09/MF A01		DE90513800	
90-059	15:44967	NTIS (US Sales Only), PC A03/MF A01		DE90513801	
90-060	15:44968	NTIS (US Sales Only), PC A06/MF A01		DE90513802	
90-069	15:45165	NTIS (US Sales Only), PC A04/MF A01		DE90513762	
JAYCOR-J–					
650-87-002/2461	15:45213	*See* AD-A–221233/0/XAB			
JET-R–					
89-17	15:46153	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635930	
JINR–					
7-33-88	15:45662	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90706118	
K/CSD/TM–					
94	15:46302	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014871	MF-505
KCP–					
613-4172	15:46301	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016430	MF-705
613-4326	15:44794	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016283	MF-701
613-4410	15:44064	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016282	MF-701
KEK–					
89-10	15:45129	NTIS (US Sales Only), PC A06/MF A01		DE90513916	
KEK-PR–					
89-2	15:45668	NTIS (US Sales Only), PC A18/MF A01		DE90513793	
KFK-PEF–					
66	15:45277	NTIS (US Sales Only), PC A14/MF A01		DE90517430	
KURRI-TR–					
324	15:45135	NTIS (US Sales Only), PC A03/MF A01		DE90513927	
326	15:46267	NTIS (US Sales Only), PC A04/MF A01		DE90513928	
330	15:46059	NTIS (US Sales Only), PC A07/MF A01		DE90513870	
331	15:43953	NTIS (US Sales Only), PC A05/MF A01		DE90513871	
333	15:45908	NTIS (US Sales Only), PC A06/MF A01		DE90513872	
KWU-R–					
917/86/013	15:43954	NTIS (US Sales Only), PC A05/MF A01		DE90517364	
LA–					
11211-Vol.2	15:43716	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015022	
11732-M	15:46303	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015629	
11787-MS	15:43955	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014840	MF-814
11794-MS	15:45336	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014818	MF-902
11842-P	15:45791	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014841	MF-410
11857-C	15:45097	NTIS, PC A22/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014820	MF-405; MF-414
11864-MS	15:44013	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015479	MF-706; MF-722
11867-MS	15:43956	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015705	MF-706
11875-PR	15:45909	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016655	PC-910
11892-M	15:43957	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015670	MF-700
11908-MS	15:45200	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015396	MF-705
LA-UR–					
89-2875	15:46219	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016441	MF-910
90-1499	15:46060	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012147	MF-904
90-1500	15:46061	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012101	MF-904
90-2042	15:46305	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013169	MF-705
90-2082	15:46306	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013162	MF-705
90-2161	15:45201	NTIS, PC A02/MF A01 - OSTI		DE90013152	MF-906
90-2204	15:44854	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015106	MF-705

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LA-UR-					
90-2209	15:44014	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015105	MF-706
90-2255	15:43918	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015099	MF-700
90-2272	15:46107	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015034	MF-910
90-2312	15:44015	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015029	MF-700
90-2320	15:45202	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015028	MF-706
90-2322	15:46220	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015026	MF-906
90-2374	15:45669	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014915	MF-910
90-2378	15:44016	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014914	MF-700
90-2437	15:45757	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014903	MF-910
90-2483	15:45216	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014899	
90-2516	15:44635	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014696	MF-704
90-2538	15:44488	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015055	MF-110
90-2552	15:45539	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015056	MF-406; MF-408
90-2566	15:43958	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015059	MF-711
90-2567	15:44636	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014980	MF-701; MF-704
90-2604	15:46330	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014975	
90-2614	15:46307	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014974	MF-905
90-2631	15:45799	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016467	MF-412
90-2776	15:45800	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016493	MF-414
90-2861	15:45870	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016444	MF-910
90-2864	15:46154	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016443	MF-426
90-2868	15:46155	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016442	MF-424
90-776	15:46304	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90008944	MF-905
LAL-					
89-11	15:45792	NTIS (US Sales Only), PC A10/MF A01		DE90514634	
89-13	15:45793	NTIS (US Sales Only), PC A06/MF A01		DE90514631	
89-23	15:45794	NTIS (US Sales Only), PC A03/MF A01		DE90514611	
89-24	15:45795	NTIS (US Sales Only), PC A03/MF A01		DE90514612	
89-26	15:45796	NTIS (US Sales Only), PC A02/MF A01		DE90514613	
89-27	15:45797	NTIS (US Sales Only), PC A02/MF A01		DE90514614	
89-28	15:45104	NTIS (US Sales Only), PC A03/MF A01		DE90514610	
89-29	15:45798	NTIS (US Sales Only), PC A03/MF A01		DE90514615	
LAL-RT-					
89-05	15:45105	NTIS (US Sales Only), PC A03/MF A01		DE90514616	
89-08	15:45166	NTIS (US Sales Only), PC A02/MF A01		DE90514624	
89-10	15:45152	NTIS (US Sales Only), PC A02/MF A01		DE90514625	
LBL-					
24910	15:45649	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016631	MF-403
24911	15:45650	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016620	MF-403
26594	15:45651	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015310	MF-802
26852	15:43959	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014509	MF-815
26870	15:44161	NTIS, PC A02/MF A01 - OSTI		DE90015718	MF-252
26871	15:44152	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015303	MF-251
26872	15:44153	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015306	MF-251
27025-Rev.	15:44489	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016626	
27045	15:44004	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016618	PC-802
27148-Rev.	15:45591	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014889	PC-407
27170	15:45467	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014883	PC-607
27435	15:46331	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014888	PC-405
27568	15:44505	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016629	MF-350
27902	15:44506	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015311	MF-350
28167	15:46221	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015724	MF-414
28366	15:44795	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014894	PC-404
28570	15:45106	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016646	PC-411
28669	15:44695	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015309	MF-404
28702	15:46108	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016647	PC-411
28703	15:45136	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015719	MF-420
28710	15:43686	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016633	MF-113
28788-Extd.Abst.	15:46062	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015312	MF-406
28798	15:46332	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014891	PC-405
28818	15:45652	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016632	MF-403
28851	15:44159	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015727	MF-251
28853	15:45137	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016616	PC-414
28881	15:45107	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014892	PC-405
28938	15:45653	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016643	MF-403
28954	15:44637	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014035	MF-404
28965	15:44875	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015623	MF-404
28971	15:44154	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015726	MF-251
28993	15:44696	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016640	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
29001	15:45167	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015313	MF-405; MF-406
29034	15:44638	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015299	MF-401; MF-404
29036	15:44796	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015632	MF-404
29045	15:44160	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015725	MF-251
29046	15:44155	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015728	MF-251
29101	15:45670	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015630	MF-414
29115	15:45775	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016636	MF-414
29118	15:44933	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015317	MF-212
29135	15:45963	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015721	MF-413
29136	15:45844	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015722	MF-413
29143	15:45953	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015723	MF-413
29148	15:45108	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016645	MF-411
29150	15:45191	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015298	MF-406
29160	15:45978	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015308	MF-413
29172	15:45933	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015638	MF-411
29174	15:46063	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015634	MF-414
29175	15:46064	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015635	MF-414
29193	15:45138	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016617	PC-411
29203	15:45654	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015692	MF-403
29206	15:44797	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015307	MF-404
29214	15:44798	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015314	MF-404
29215	15:46083	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015637	MF-406
29216	15:44697	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015633	MF-404
29228	15:45098	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015430	MF-414
29229	15:45099	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015315	MF-414
29235	15:45655	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015300	MF-802
29240	15:45526	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015316	MF-408
29244	15:45139	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015720	MF-414
29248	15:44799	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015466	MF-401
29256	15:45100	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015639	MF-413
LBL-PUB–					
475-Rev.-6/90	15:45203	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015631	MF-406
LRC–					
90-16	15:46142	*See* DOE/ER/53263–9			
LUND-MPH–					
90-01	15:46010	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636347	
LYCEN–					
89-02	15:45720	NTIS (US Sales Only), PC A17/MF A01		DE90514570	
MC–					
633G580	15:44201	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
87-I-29A	15:43835	*See* PB–90-236878/XAB			
MEM–					
90-03896	15:44386	PC Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, CAN R3C 0V8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
MICROLOG–					
89-00495	15:43854	*See* ERL–88-62(TR)			
89-04483	15:43804	*See* STA–89-04483			
89-04495	15:43785	*See* CANMET–89-04495			
89-05127	15:43809	*See* EEA–89-05127			
89-05418	15:45642	*See* GSC–P88-20			
89-05665	15:44164	*See* EMR/RE–M91-7/16-1988E			
90-00377	15:44420	*See* C-CORE–89-11			
90-00820	15:44373	*See* ISTC–90-00820			
90-01031	15:43811	*See* CERI–90-01031			
90-01036	15:43822	*See* CERI–90-01036			
90-01732	15:44560	*See* OME–90-01732			
90-02137	15:44095	*See* EC/WSC–EN36-418/1988-6			
90-02787	15:44096	*See* EC/WSC–EN36-418/1988-8			
90-02800	15:44070	*See* PI–PI-X-77F			
90-03338	15:44466	*See* COGLA–90-03338			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-03379	15:44803	*See* NDA/NF–90-03379			
90-03384	15:43899	*See* GCR–90-03384			
90-03385	15:43803	*See* PRI–90-03385			
90-03386	15:43856	*See* PRI–90-03386			
90-03387	15:43797	*See* ER/C–90-03387			
90-03523	15:45046	*See* OH/RD–89-280-K			
90-03608	15:44476	*See* HQ–90-03608			
90-03658	15:44385	*See* EMR–BT31-2-1991-III-13			
90-03664	15:43888	*See* NPA–BT31-2/1991-III-31			
90-03685	15:44455	*See* NEB-SS–BT31-2/1991-III-14			
90-03742	15:45241	*See* BCEP–90-03742			
90-03779	15:44501	*See* CMHC–90-03779			
90-03896	15:44386	*See* MEM–90-03896			
90-03960	15:44090	*See* UWO/FES–90-03960			
90-03963	15:43903	*See* ZE–C0874074			
90-03993	15:45469	*See* OH/RD–89-292-K			
90-03997	15:44804	*See* OH/RD–89-184-K			
90-04097	15:44525	*See* FERIC–TP10081E			
90-04172	15:44485	*See* PEEF–90-04172			
90-04249	15:44456	*See* NEB-SS–NE1-1989F			
MISC–					
90085	15:43933	*See* DOE/ID–10273			
MIT/LCS/TR–					
446	15:46273	*See* AD-A–221398/1/XAB			
475	15:46280	*See* AD-A–221757/8/XAB			
MLM–					
3635	15:45730	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014885	PC-411
3645(OP)	15:45221	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015652	MF-706
3646(OP)	15:45185	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015743	MF-706
3647(OP)	15:45222	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015741	MF-742
3648(OP)	15:45223	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015744	MF-741
3649(OP)	15:45224	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015745	MF-742
3650(OP)	15:44639	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015746	MF-742
3651(OP)	15:45186	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015747	MF-706
MPI-PAE/PTh–					
35/89	15:45820	*See* UM-P–89/66			
MPUB–					
1/90	15:43887	Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2. Prices: PRICES UPON REQUEST			
61/90	15:43871	Manitoba Public Utilities Board, 280 Smith Street, 2nd Floor, Winnipeg, MB, CAN R3C 1K2. Prices: PRICES UPON REQUEST			
MTL-TR–					
90-18	15:44285	*See* AD-A–221386/6/XAB			
MTU-TB–					
81/251	15:44640	Copy held by UB/TIB Hannover			
N–					
90-21849	15:44641	NTIS, PC A12/MF A02			
90-22426	15:45672	NTIS, PC A03/MF A01			
90-22510	15:45674	NTIS, PC A03/MF A01			
90-23294	15:45169	NTIS, PC A15/MF A02; 1 functional color page			
NAE-AN–					
58	15:44592	*See* AD-A–220988/0/XAB			
NAS–					
1.26:181296	15:45674	*See* N–90-22510			
1.26:185219	15:44641	*See* N–90-21849			
1.26:186256	15:45672	*See* N–90-22426			
1.55:3071	15:45169	*See* N–90-23294			
NASA-CP–					
3071	15:45169	*See* N–90-23294			
NASA-CR–					
181296	15:45674	*See* N–90-22510			
185219	15:44641	*See* N–90-21849			
186256	15:45672	*See* N–90-22426			
NBI-HE–					
90-19	15:45871	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635694	
90-21	15:45872	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635695	
90-22	15:46109	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635675	

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NCAR/CT–					
124	15:45675	*See* PB–90-214487/XAB			
NCGS/BULL–					
92	15:45656	OSTI; Geological Survey Section, P.O. Box 27687, Raleigh, NC 27611-7687		TI90015808	
ND-R–					
1173(S)(pt.9)	15:44233	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90637080	
NDA/NF–					
90-03379	15:44803	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NEANDC(E)–					
302	15:46036	*See* UKNDC(89)-P–116			
NEB-SS–					
BT31-2/1991-III-14	15:44455	PC National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, CAN K1A 0E5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $4.00; OTHER COUNTRIES: $4.80 CAN; MF $10 CAN			
NE1-1989F	15:44456	PC National Energy Board, Regulatory Support Office, 473 Albert Street, Ottawa, Ont., CAN K1A 0E5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
NERDDP-EG–					
89-198	15:43748	Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia			
89-799	15:43771	Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia			
89-817	15:43749	Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia			
89-820	15:43750	Department of Primary Industries and Energy, GPO Box 858, Canberra, ACT 2601, Australia			
NFL–					
60	15:45955	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636395	
61	15:45170	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637153	
NIPER–					
422	15:44876	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000247	PC-125
479	15:43855	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015393	MF-125
479-Vol.2	15:43801	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015849	MF-122
481	15:43802	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015848	MF-122; MF-125
NISTIR–					
89/4125	15:45595	*See* PB–90-242298/XAB			
NORD–					
1990-57	15:44218	NTIS (US Sales Only), PC A13/MF A01; OSTI; INIS		DE90637065	
NOSC/TD–					
1670	15:46281	*See* AD-A–221780/0/XAB			
NPA–					
BT31-2/1991-III-31	15:43888	PC Northern Pipeline Agency, Lester B. Pearson Building, 125 Sussex Drive, Ottawa, ON, CAN K1A 0G2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $3.00; OTHER COUNTRIES: $3.60 CAN; MF $10 CAN			

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NRL-MR–					
6613	15:45239	*See* AD-A–221074/8/XAB			
6622	15:45025	*See* AD-A–221818/8/XAB			
6627	15:45000	*See* AD-A–221075/5/XAB			
6636	15:45083	*See* AD-A–221755/2/XAB			
6645	15:45708	*See* AD-A–221577/0/XAB			
NSWC-TR–					
90-48	15:44779	*See* AD-A–221616/6/XAB			
NTP-TR–					
370	15:45620	*See* PB–90-231127/XAB			
NUREG–					
0040-Vol.14-No.1	15:44255	NTIS, PC A10/MF A01 - GPO; OSTI; INIS		TI90015415	
0090-Vol.13-No.1	15:44340	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90015626	
0540-Vol.12-No.6	15:44256	NTIS, PC A15/MF A01 - GPO; OSTI; INIS		TI90015678	
0750-Vol.31-No.6	15:44257	NTIS, PC A07/MF A01 - GPO; OSTI; INIS		TI90015864	
1214-Rev.6	15:44258	NTIS, PC A06/MF A01 - GPO; OSTI; INIS		TI90016197	
1409	15:44259	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90015172	
NUREG/CR–					
5373	15:44341	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90016113	
5385	15:44219	NTIS, PC A11/MF A01 - GPO; OSTI; INIS		TI90015805	
5448	15:44342	NTIS, PC A10/MF A01; OSTI; INIS		TI90016215	
5528	15:44343	NTIS, PC A14/MF A01 - GPO; OSTI; INIS		TI90015628	
5552	15:44234	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90015770	
5579	15:44344	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90015402	
5591-Vol.1-No.1	15:44220	NTIS, PC A03/MF A01; OSTI; INIS		TI90016112	
5607	15:45468	NTIS, PC A18/MF A01 - GPO; OSTI; INIS		TI90015806	
NUREG/IA–					
0033	15:44345	NTIS, PC A06/MF A01 - GPO - OSTI		TI90015568	
NVO–					
334-2	15:43960	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015030	PC-814
NYSERDA–					
90-7	15:44578	OSTI; New York State Energy Research and Development, Two Rockefeller Plaza, Albany, NY 12223		TI90015400	
NZERDC–					
155	15:43697	New Zealand Energy Research and Development Committee, Wellington (New Zealand)			
155	15:43717	New Zealand Energy Research and Development Committee, Wellington (New Zealand)			
OCS/EIS/EA/MMS–					
90-0005	15:43841	OSTI; US Department of the Interior, Minerals Management Service, 381 Elden Street, Herndon, VA 22070		TI90015706	
OH/GE–					
02	15:44457	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
OH/RD–					
260T507	15:44367	Canadian Electrical Association, Research & Development, Suite No. 500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS, MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
709U603	15:44559	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
89-184-K	15:44804	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-280-K	15:45046	PC Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
89-292-K	15:45469	PC Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, CAN M8Z 5S4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $10.00 CAN; MF $10 CAN			
OME–					
90-01732	15:44560	PC Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, CAN M7A 2B7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
ONRFE-SCI-INFO-BULL–					
13(4)88	15:44805	NTIS, PC A05/MF A01			
ORNL–					
6622	15:44526	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014767	MF-920
6626/S1	15:44527	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014816	MF-330
6627	15:44426	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014766	MF-500
ORNL/ATD–					
2	15:45225	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014761	
33	15:44806	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016207	MF-404
39	15:45047	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016208	MF-406
ORNL/FTR–					
2635	15:45731	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016115	MF-411
2680	15:44203	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016116	MF-404
2727	15:45171	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015622	MF-407
2817	15:46222	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015621	MF-413
3683	15:44101	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015707	MF-225
3686	15:45639	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015768	MF-407
3688	15:46308	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015136	MF-405
3690	15:44969	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015802	MF-706
3695	15:45527	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015836	MF-408
3698	15:46084	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015767	MF-406
3700	15:46309	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015801	MF-405
3701	15:46223	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015803	MF-420
3703	15:46310	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016515	MF-405
3707	15:44855	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015974	MF-401
3710	15:44642	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015833	MF-404
3712	15:46065	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016132	MF-413
ORNL/M–					
1226	15:44507	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014762	MF-350
ORNL/NSP–					
90/7	15:44432	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014768	MF-500
ORNL/RASA–					
89/3	15:45337	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015834	MF-511
90/4	15:45338	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015785	MF-511
ORNL/Sub–					
85-27409/5	15:44068	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014769	MF-243
85-27412/5-P1	15:44072	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015708	MF-243
85-27413/5	15:44069	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014784	MF-243
86-55936/01	15:43687	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015711	MF-114
86-95900/02	15:43688	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015710	MF-114
86-SB195/1	15:44599	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014783	MF-335
ORNL/TM–					
11314	15:44234	*See* NUREG/CR–5552			
11323	15:44365	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014781	MF-900
11519	15:44147	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014777	
11542	15:46224	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014790	PC-427
11546	15:46225	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014817	MF-420
11564	15:44008	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014775	MF-511
11568-Vol.1-No.1	15:44220	*See* NUREG/CR–5591-Vol.1-No.1			
11570	15:45554	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016681	MF-407

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OSM–					
002	15:43711	*See* PB–90-225681/XAB			
119	15:43752	*See* PB–90-229311/XAB			
OZ–					
88/15	15:45877	*See* UM-P–88/111(rev.)			
89/11	15:45846	*See* UM-P–89/39			
89/16	15:45878	*See* UM-P–89/52			
89/17	15:45879	*See* UM-P–89/53			
89/19	15:45820	*See* UM-P–89/66			
89/24	15:45847	*See* UM-P–89/77			
89/25	15:46117	*See* UM-P–89/80			
89/34	15:46119	*See* UM-P–89/102			
OZ-P–					
89/13	15:46114	*See* UM-P–89/47			
89/27	15:45848	*See* UM-P–89/82			
P–					
300-90-001	15:43810	*See* CEC–90015481			
PATENTS-USA–					
4,884,886/A/	15:45179	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,904,700/A/	15:44091	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,905,087/A/	15:45080	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,905,169/A/	15:45210	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,905,244/A/	15:44024	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,906,951/A/	15:45079	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,907,489/A/	15:45226	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,907,509/A/	15:45227	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,907,881/A/	15:45078	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,907,885/A/	15:45209	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4,908,334/A/	15:44843	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4917974/A/	15:44378	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
4921738/A/	15:44776	Patent and Trademark Office, Box 9, Washington, DC 20232 (USA)			
Application7-480,197	15:43755	NTISPC N03/MF A01			
Application7-477,395	15:44025	NTISPC N03/MF A01			
Application7-501,461	15:45077	NTISPC N03/MF A01			
Application7-472,538	15:45537	NTISPC N03/MF A01			
PB–					
86-155033/XAB	15:45278	NTIS, PC A08/MF A01			
89-166136	15:43689	NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA			
89-166144	15:43690	NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA			
89-166151	15:43691	NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA			
89-166177	15:43692	NTIS, 5285 Port Royal Road, Springfield, VA 22161, USA			
90-184094/XAB	15:43842	NTIS, PC A03/MF A01			
90-186487/XAB	15:45470	NTIS, PC A04/MF A01			
90-213893/XAB	15:45279	NTIS, PC A19/MF A03			
90-214487/XAB	15:45675	NTIS, PC A15/MF A02			
90-214834/XAB	15:45471	NTIS, PC A03/MF A01			
90-215054/XAB	15:45613	NTIS, PC A05/MF A01			
90-215062/XAB	15:45472	NTIS, PC A04/MF A01			
90-215112/XAB	15:44580	NTIS, PC A07/MF A01			
90-215120/XAB	15:44393	NTIS, PC A05/MF A01			
90-215203/XAB	15:45280	NTIS, PC A08/MF A01			
90-215989/XAB	15:45614	NTIS, PC A03/MF A01			
90-216417/XAB	15:44528	NTIS, PC A12/MF A02			
90-220807/XAB	15:44210	NTIS, PC A04/MF A01			

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90-221722/XAB	15:45615	NTIS, PC A03/MF A01			
90-221748/XAB	15:45616	NTIS, PC A02/MF A01			
90-221870/XAB	15:45281	NTIS, PC A03/MF A01			
90-221896/XAB	15:45282	NTIS, PC A03/MF A01			
90-221904/XAB	15:45283	NTIS, PC A03/MF A01			
90-221912/XAB	15:45284	NTIS, PC A02/MF A01			
90-221920/XAB	15:45285	NTIS, PC A03/MF A01			
90-221946/XAB	15:44083	NTIS, PC A03/MF A01			
90-222126/XAB	15:45286	NTIS, PC A08/MF A01			
90-222530/XAB	15:45473	NTIS, PC A03/MF A01			
90-222696/XAB	15:45287	NTIS, PC A11/MF A02			
90-222704/XAB	15:45288	NTIS, PC A13/MF A02			
90-223793/XAB	15:43848	NTIS, PC EE10/MF E10			
90-223819/XAB	15:44807	NTIS, PC EE06/MF E06			
90-223868/XAB	15:44808	NTIS, PC EE06/MF E06			
90-223926/XAB	15:45657	NTIS, PC EE06/MF E06			
90-224833/XAB	15:44529	NTIS, PC A05/MF A01			
90-224874/XAB	15:45528	NTIS, PC A03/MF A01			
90-224957/XAB	15:43849	NTIS, PC A06/MF A01			
90-224965/XAB	15:43833	NTIS, PC A03/MF A01			
90-224999/XAB	15:43751	NTIS, PC A03/MF A01			
90-225293/XAB	15:45289	NTIS, PC A06/MF A01			
90-225376/XAB	15:44530	NTIS, PC A06/MF A01			
90-225533/XAB	15:45474	NTIS, PC A05/MF A01			
90-225574/XAB	15:45475	NTIS, PC A02/MF A01			
90-225590/XAB	15:45617	NTIS, PC A01/MF A01			
90-225608/XAB	15:44531	NTIS, PC A13/MF A02			
90-225624/XAB	15:45618	NTIS, PC A04/MF A01			
90-225640/XAB	15:45619	NTIS, PC A03/MF A01			
90-225673/XAB	15:43710	NTIS, PC A21/MF A03			
90-225681/XAB	15:43711	NTIS, PC A04/MF A01			
90-225806/XAB	15:44602	NTIS, PC A05/MF A01			
90-225830/XAB	15:44603	NTIS, PC A06/MF A01			
90-226028/XAB	15:45676	NTIS, PC A08/MF A01			
90-226036/XAB	15:45677	NTIS, PC A05/MF A01			
90-226077/XAB	15:45339	NTIS, PC A10/MF A02			
90-226150/XAB	15:45476	NTIS, PC A19/MF A03			
90-226168/XAB	15:44956	NTIS, PC A09/MF A01			
90-226333/XAB	15:43857	NTIS, PC A09/MF A01			
90-226341/XAB	15:44490	NTIS, PC A03/MF A01			
90-226614/XAB	15:45290	NTIS, PC A05/MF A01			
90-227117/XAB	15:45477	NTIS, PC A21/MF A03			
90-227125/XAB	15:45478	NTIS, PC A08/MF A01			
90-227257/XAB	15:45479	NTIS, PC A03/MF A01			
90-227422/XAB	15:43866	NTIS, PC EE06/MF E06			
90-227950/XAB	15:45340	NTIS, PC A09/MF A01			
90-228057/XAB	15:44209	NTIS, PC A09/MF A01			
90-228065/XAB	15:43882	NTIS, PC A04/MF A01			
90-228073/XAB	15:43893	NTIS, PC A03/MF A01			
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90-228115/XAB	15:43859	NTIS, PC A03/MF A01			
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90-228164/XAB	15:43896	NTIS, PC A05/MF A01			
90-228172/XAB	15:43861	NTIS, PC A04/MF A01			
90-228206/XAB	15:44346	NTIS, PC A03/MF A01			
90-228248/XAB	15:45480	NTIS, PC A06/MF A01			
90-228511/XAB	15:45217	NTIS, PC A03/MF A01			
90-228610/XAB	15:45291	NTIS, PC A12/MF A02			
90-228628/XAB	15:45292	NTIS, PC A04/MF A01			
90-228636/XAB	15:44204	NTIS, PC A04/MF A01			
90-228826/XAB	15:45293	NTIS, PC EE99/MF E99			
90-228834/XAB	15:44581	NTIS, PC A08/MF A01			
90-228842/XAB	15:44582	NTIS, PC A25/MF A04			
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90-228875/XAB	15:45481	NTIS, PC A03/MF A01			
90-228883/XAB	15:45482	NTIS, PC A03/MF A01			
90-228891/XAB	15:45483	NTIS, PC A03/MF A01			
90-228909/XAB	15:45484	NTIS, PC A03/MF A01			
90-228925/XAB	15:45485	NTIS, PC A03/MF A01			

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90-228933/XAB	15:45486	NTIS, PC A03/MF A01			
90-228941/XAB	15:45487	NTIS, PC A03/MF A01			
90-228958/XAB	15:43843	NTIS, PC A03/MF A01			
90-228966/XAB	15:43844	NTIS, PC A03/MF A01			
90-229253/XAB	15:43758	NTIS, PC A99/MF A04			
90-229311/XAB	15:43752	NTIS, PC A03/MF A01			
90-229782/XAB	15:45294	NTIS, PC A06/MF A01			
90-229832/XAB	15:45488	NTIS, PC A07/MF A01			
90-229865/XAB	15:43753	NTIS, PC A03/MF A01			
90-229899/XAB	15:43703	NTIS, PC A07/MF A01			
90-229907/XAB	15:43704	NTIS, PC A07/MF A01			
90-230129/XAB	15:43897	NTIS, PC A04/MF A01			
90-230152/XAB	15:43898	NTIS, PC A03/MF A01			
90-230442/XAB	15:43772	NTIS, PC A03/MF A01			
90-230459/XAB	15:43773	NTIS, PC A03/MF A01			
90-231101/XAB	15:44078	NTIS, PC A04/MF A01			
90-231119/XAB	15:44532	NTIS, PC A23/MF A03			
90-231127/XAB	15:45620	NTIS, PC A09/MF A01			
90-231192/XAB	15:44994	NTIS, PC A05/MF A01			
90-231200/XAB	15:45621	NTIS, PC A04/MF A01			
90-231226/XAB	15:45658	NTIS, PC A06/MF A01			
90-231259/XAB	15:45295	NTIS, PC A08/MF A01			
90-231267/XAB	15:45489	NTIS, PC A16/MF A02			
90-231275/XAB	15:43698	NTIS, PC A07/MF A01			
90-231358/XAB	15:45296	NTIS, PC A03/MF A01			
90-231374/XAB	15:45297	NTIS, PC A14/MF A02			
90-231499/XAB	15:44109	NTIS, PC A03/MF A01			
90-231655/XAB	15:45341	NTIS, PC A03/MF A01			
90-231663/XAB	15:45490	NTIS, PC A05/MF A01			
90-231689/XAB	15:43845	NTIS, PC A04/MF A01			
90-231697/XAB	15:45491	NTIS, PC A04/MF A01			
90-231838/XAB	15:43774	NTIS, PC A03/MF A01			
90-231929/XAB	15:45298	NTIS, PC A03/MF A01			
90-231945/XAB	15:45492	NTIS, PC A05/MF A01			
90-232034/XAB	15:44156	NTIS, PC A05/MF A01			
90-232133/XAB	15:45622	NTIS, PC A02/MF A01			
90-232208/XAB	15:45592	NTIS, PC A03/MF A01			
90-232216/XAB	15:45623	NTIS, PC A03/MF A01			
90-232257/XAB	15:45593	NTIS, PC A02/MF A01			
90-232265/XAB	15:45624	NTIS, PC A02/MF A01			
90-232281/XAB	15:45299	NTIS, PC A03/MF A01			
90-232323/XAB	15:45300	NTIS, PC A02/MF A01			
90-232331/XAB	15:45625	NTIS, PC A03/MF A01			
90-232349/XAB	15:45594	NTIS, PC A03/MF A01			
90-232414/XAB	15:44493	NTIS, PC A03/MF A01			
90-232463/XAB	15:43930	NTIS, PC A02/MF A01			
90-232471/XAB	15:44483	NTIS, PC A03/MF A01			
90-232513/XAB	15:43775	NTIS, PC A03/MF A01			
90-232539/XAB	15:43846	NTIS, PC A13/MF A02			
90-232570/XAB	15:45493	NTIS, PC A05/MF A01			
90-233149/XAB	15:43712	NTIS, PC A14/MF A02			
90-233180/XAB	15:45301	NTIS, PC A02/MF A01			
90-233214/XAB	15:45678	NTIS, PC A03/MF A01			
90-233305/XAB	15:45679	NTIS, PC A03/MF A01			
90-233495/XAB	15:44643	NTIS, PC EE03/MF E03			
90-233644/XAB	15:43834	NTIS, PC A03/MF A01			
90-233727/XAB	15:45302	NTIS, PC A04/MF A01			
90-233792/XAB	15:44957	NTIS, PC A05/MF A01			
90-233800/XAB	15:44508	NTIS, PC A05/MF A01			
90-233818/XAB	15:43754	NTIS, PC A05/MF A01			
90-233909/XAB	15:45494	NTIS, PC A03/MF A01			
90-233933/XAB	15:45495	NTIS, PC A07/MF A01			
90-233982/XAB	15:44509	NTIS, PC A15/MF A02			
90-235086/XAB	15:43713	NTIS, PC A03/MF A01			
90-235094/XAB	15:45303	NTIS, PC A04/MF A01			
90-235102/XAB	15:45496	NTIS, PC A04/MF A01			
90-235128/XAB	15:45497	NTIS, PC A03/MF A01			
90-235425/XAB	15:44533	NTIS, PC A03/MF A01			
90-235664/XAB	15:44477	NTIS, PC A16/MF A02			
90-235698/XAB	15:43718	NTIS, PC A07/MF A01			
90-235714/XAB	15:45304	NTIS, PC A10/MF A02			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-235755/XAB	15:44510	NTIS, PC A06/MF A01			
90-235771/XAB	15:43699	NTIS, PC A07/MF A01			
90-235789/XAB	15:45305	NTIS, PC A06/MF A01			
90-235797/XAB	15:45498	NTIS, PC A13/MF A02			
90-235839/XAB	15:43719	NTIS, PC A04/MF A01			
90-235847/XAB	15:45306	NTIS, PC A04/MF A01			
90-235854/XAB	15:45307	NTIS, PC A03/MF A01			
90-235862/XAB	15:45308	NTIS, PC A05/MF A01			
90-235870/XAB	15:45499	NTIS, PC A03/MF A01			
90-235896/XAB	15:45500	NTIS, PC A04			
90-235904/XAB	15:45501	NTIS, PC A06			
90-235953/XAB	15:45309	NTIS, PC EE99/MF E99			
90-235961/XAB	15:45310	NTIS, PC A04/MF A01			
90-235979/XAB	15:45311	NTIS, PC A16/MF A02			
90-235987/XAB	15:45312	NTIS, PC A12/MF A02			
90-235995/XAB	15:45313	NTIS, PC A08/MF A01			
90-236001/XAB	15:45314	NTIS, PC A17/MF A02			
90-236019/XAB	15:45315	NTIS, PC A06/MF A01			
90-236027/XAB	15:45316	NTIS, PC A17/MF A03			
90-236043/XAB	15:45502	NTIS, PC A07/MF A01			
90-236753/XAB	15:45503	NTIS, PC A06/MF A01			
90-236878/XAB	15:43835	NTIS, PC A04/MF A01			
90-236928/XAB	15:43776	NTIS, PC A03/MF A01			
90-239658/XAB	15:43705	NTIS, PC A05/MF A01			
90-239724/XAB	15:43924	NTIS, PC A04/MF A01			
90-239740/XAB	15:44511	NTIS, PC A06/MF A01			
90-239815/XAB	15:43862	NTIS, PC A12/MF A02			
90-239922/XAB	15:43693	NTIS, PC A11/MF A02			
90-240342/XAB	15:43863	NTIS, PC A12/MF A02			
90-240367/XAB	15:43864	NTIS, PC A04/MF A01			
90-240375/XAB	15:44079	NTIS, PC A05/MF A01			
90-240383/XAB	15:43905	NTIS, PC A03/MF A01			
90-240417/XAB	15:43961	NTIS, PC A03/MF A01			
90-240821/XAB	15:45626	NTIS, PC A03/MF A01			
90-241738/XAB	15:45659	NTIS, PC A18/MF A03			
90-242017/XAB	15:45504	NTIS, PC A03/MF A01			
90-242298/XAB	15:45595	NTIS, PC A04/MF A01			
90-242397/XAB	15:45342	NTIS, PC A07/MF A01			
90-243999/XAB	15:45505	NTIS, PC A03/MF A01			
90-244286/XAB	15:43874	NTIS, PC EE99/MF E99			
90-244294/XAB	15:43875	NTIS, PC A09/MF A02			
90-244302/XAB	15:43876	NTIS, PC A09/MF A02			
90-244310/XAB	15:43877	NTIS, PC A14/MF A02			
90-244328/XAB	15:43878	NTIS, PC A13/MF A02			
90-244336/XAB	15:43879	NTIS, PC A03/MF A01			
90-244344/XAB	15:43880	NTIS, PC A06/MF A01			
90-244351/XAB	15:43881	NTIS, PC A13/MF A02			
90-247107/XAB	15:45506	NTIS, PC A03/MF A01			
90-502253/XAB	15:45317	NTISCP D01			
90-502311/XAB	15:45507	NTISCD-ROM $45.00			
90-502337/XAB	15:45508	NTISCP D02			
90-502378/XAB	15:43777	NTISCP T02			
90-502410/XAB	15:45318	NTISCP D01			
90-591160/XAB	15:43925	NTISSubscription			
90-591310/XAB	15:44394	NTISSubscription			
90-872391/XAB	15:44132	NTISPC N01/MF N01			
90-872458/XAB	15:44084	NTISPC N01/MF N01			
90-872508/XAB	15:45509	NTISPC N01/MF N01			
90-872656/XAB	15:43695	NTISPC N01/MF N01			
90-872672/XAB	15:44567	NTISPC N01/MF N01			
90-872748/XAB	15:44568	NTISPC N01/MF N01			
90-872847/XAB	15:45510	NTISPC N01/MF N01			
90-872854/XAB	15:45048	NTISPC N01/MF N01			
90-872920/XAB	15:44376	NTISPC N01/MF N01			
90-873043/XAB	15:44644	NTISPC N01/MF N01			
90-873290/XAB	15:46085	NTISPC N01/MF N01			
90-873308/XAB	15:46086	NTISPC N01/MF N01			
90-873316/XAB	15:44380	NTISPC N01/MF N01			
90-873324/XAB	15:44381	NTISPC N01/MF N01			
90-873332/XAB	15:44809	NTISPC N01/MF N01			
90-873357/XAB	15:45049	NTISPC N01/MF N01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
90-873399/XAB	15:45627	NTISPC N01/MF N01			
90-873464/XAB	15:45231	NTISPC N01/MF N01			
90-873522/XAB	15:45628	NTISPC N01/MF N01			
90-873555/XAB	15:45629	NTISPC N01/MF N01			
90-873563/XAB	15:45050	NTISPC N01/MF N01			
90-873639/XAB	15:44698	NTISPC N01/MF N01			
90-873704/XAB	15:44645	NTISPC N01/MF N01			
90-873720/XAB	15:45319	NTISPC N01/MF N01			
90-873738/XAB	15:45320	NTISPC N01/MF N01			
90-873860/XAB	15:45051	NTISPC N01/MF N01			
90-873878/XAB	15:45052	NTISPC N01/MF N01			
90-873928/XAB	15:45204	NTISPC N01/MF N01			
90-873977/XAB	15:45873	NTISPC N01/MF N01			
90-874041/XAB	15:44478	NTISPC N01/MF N01			
90-874108/XAB	15:46226	NTISPC N01/MF N01			
PCCF-T–					
88-08	15:46158	NTIS (US Sales Only), PC A06/MF A01		DE90514633	
89-02	15:46014	NTIS (US Sales Only), PC A05/MF A01		DE90514635	
89-03	15:45941	NTIS (US Sales Only), PC A09/MF A01		DE90514617	
PEEF–					
90-04172	15:44485	PC Prince Edward Island. Dept. of Energy and Forestry, Shaw Bldg., 105 Rochford St., PO Box 2000, Charlottetown, PE, CAN C1A 7N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
PFC/CP–					
90-1	15:46143	*See* DOE/ET/51013–283			
PFC/RR–					
90-9	15:46144	*See* DOE/ET/51013–284			
PI–					
PI-X-77F	15:44070	PC Forestry Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
PINSTECH/NPD–					
124	15:46066	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635768	
PINSTECH/RIAD–					
120	15:46049	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636330	
PIRSEM–					
0243.1	15:44157	NTIS (US Sales Only), PC A15/MF A01		DE90514554	
0245	15:44162	NTIS (US Sales Only), PC A03/MF A01		DE90514540	
0251	15:44163	NTIS (US Sales Only), PC A03/MF A01		DE90514551	
3032	15:44133	NTIS (US Sales Only), PC A03/MF A01		DE90514546	
3295	15:44142	NTIS (US Sales Only), PC A03/MF A01		DE90514550	
PNL–					
6203	15:44512	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015558	MF-920
6450-33-HEDR	15:45321	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015837	MF-707
7100	15:44513	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014819	MF-350
7302	15:43962	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014824	MF-610
7316	15:44569	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015555	MF-920
7339	15:44344	*See* NUREG/CR–5579			
7348	15:45343	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014823	MF-603
7391	15:43963	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014829	MF-721
7417	15:44009	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016199	MF-607
7419	15:44479	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015557	MF-920
7421	15:43964	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016557	MF-602
7425	15:45344	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015835	MF-800
7430	15:43965	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014846	MF-510
7431	15:44584	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015512	MF-706
7434	15:44304	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016195	MF-700
7440	15:43966	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014876	MF-702
PNL-SA–					
15644	15:44347	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015547	MF-523
15749	15:45557	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016297	MF-408

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15936	15:45172	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015553	MF-506
16120	15:45596	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016286	MF-408
16891	15:45541	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015550	MF-408
16932	15:46227	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015546	MF-516
17012	15:44491	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015290	MF-114
17022	15:46228	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015554	MF-423
17145	15:46229	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015295	MF-530
17175	15:44646	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015294	MF-530
17302	15:46311	NTIS, PC A02/MF A01 - OSTI		DE90016362	MF-505
17391	15:43967	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015287	MF-814
17438	15:45511	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015286	MF-402
17517	15:44286	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016327	MF-420
17529	15:46230	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015293	MF-530
17548	15:46231	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016358	MF-420
17577	15:44492	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015552	MF-114
17602	15:43968	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016292	MF-512; MF-502
17612	15:45345	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015288	MF-402
17636	15:46232	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015291	MF-530
17683	15:46233	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015289	MF-420
17693	15:46053	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015302	MF-607
17771	15:43969	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016355	MF-810
17804	15:46234	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016360	MF-420
17857	15:44427	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015301	MF-900
17876	15:44647	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016363	
17896	15:46235	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016344	MF-538
17897	15:46236	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016343	MF-420
17906	15:45597	NTIS, PC A; GPO Dep.	E 1.99:	DE90015551	MF-408
17922	15:45346	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015973	MF-510
17954	15:45322	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016341	MF-402
18010	15:43926	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016340	MF-510
18089	15:46312	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016287	MF-505
18092	15:44010	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015549	MF-400
18152	15:45192	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016308	MF-310
18193	15:45598	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016295	MF-408
18229	15:46237	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016359	MF-420
18293	15:45323	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016293	MF-502
18388	15:46238	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014803	MF-423
POEF-T–					
3535	15:43907	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016194	MF-501
PPCCF-T–					
89-01	15:44856	NTIS (US Sales Only), PC A07/MF A01		DE90514618	
PPPL–					
2708	15:46159	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014821	PC-420; PC-426; PC-427
2713	15:46160	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90016045	PC-420; PC-427
2715	15:46161	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015871	PC-420; PC-427
PRI–					
90-03385	15:43803	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
90-03386	15:43856	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
PSC–					
2	15:46162	NTIS (US Sales Only), PC A03/MF A01		DE90513926	
PSI–					
60	15:45347	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90636670	
62	15:44877	NTIS (US Sales Only), PC A05/MF A01; OSTI; INIS		DE90636475	

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67	15:44279	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636992	
PTB-SE–					
25	15:43970	NTIS (US Sales Only), PC A16/MF A01		DE90517337	
PWR/CWG/P–					
(89)660	15:44224	*See* CEGB-TD/B–6259/R89			
PWR/SGWG/P–					
(89)537	15:44282	*See* CEGB-RD-B–6147/R89			
Q–					
132	15:44947	*See* DOE/ER/00038–3304			
RAL–					
90-023	15:46067	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635769	
REA-BULL–					
43-5	15:44477	*See* PB–90-235664/XAB			
REG/G–					
1.159	15:44260	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90015664	
REPT–					
3122	15:45287	*See* PB–90-222696/XAB			
RERF-TR–					
12-89	15:45600	NTIS (US Sales Only), PC A03/MF A01		DE90513644	
14-89	15:45601	NTIS (US Sales Only), PC A03/MF A01		DE90513646	
17-89	15:45602	NTIS (US Sales Only), PC A03/MF A01		DE90513647	
4-88	15:45599	NTIS (US Sales Only), PC A03/MF A01		DE90513645	
RFP–					
4390	15:44648	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90008971	MF-704
4412	15:43919	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015674	MF-704
4414	15:43991	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010808	MF-721
4419	15:46313	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015675	MF-705
4435	15:45174	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015673	MF-707
RFP-ADD–					
0001	15:45324	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016099	MF-702
RISO-M–					
2733	15:45175	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637249	
2854	15:46268	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637400	
2857	15:46239	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636060	
RM–					
123	15:43866	*See* PB–90-227422/XAB			
RPC–					
649U4587	15:44514	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
702G606	15:44205	Canadian Electrical Association, One Westmount Square, Suite 500, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
RRK–					
90-2	15:45874	NTIS (US Sales Only), PC A02/MF A01		DE90513706	
90-3	15:46111	NTIS (US Sales Only), PC A03/MF A01		DE90513707	
90-4	15:46112	NTIS (US Sales Only), PC A04/MF A01		DE90513792	
90-05	15:45680	NTIS (US Sales Only), PC A03/MF A01		DE90513791	
90-06	15:45681	NTIS (US Sales Only), PC A03/MF A01		DE90513790	
90-07	15:45682	NTIS (US Sales Only), PC A03/MF A01		DE90513789	
90-8	15:45683	NTIS (US Sales Only), PC A02/MF A01		DE90513788	
RT/COMB–					
89-15	15:43937	*See* ENEA-RT-COMB–89-15			
89-16	15:43938	*See* ENEA-RT-COMB–89-16			
89-17	15:43807	*See* ENEA-RT-COMB–89-17			
89-18	15:43939	*See* ENEA-RT-COMB–89-18			
89-19	15:43940	*See* ENEA-RT-COMB–89-19			
89-20	15:43941	*See* ENEA-RT-COMB–89-20			
89-21	15:43913	*See* ENEA-RT-COMB–89-21			
89-23	15:44242	*See* ENEA-RT-COMB–89-23			
RT/FARE–					
89-4	15:44129	*See* ENEA-RT-FARE–89-04			

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89-5	15:44130	*See* ENEA-RT-FARE–89-05			
89-9	15:44145	*See* ENEA-RTI-FARE–89-09			
RT/FUS–					
88-31	15:46211	*See* ENEA-RT-FUS–88-31			
89-9	15:46129	*See* ENEA-RT-FUS–89-09			
89-12	15:46130	*See* ENEA-RT-FUS–89-12			
89-24	15:46214	*See* ENEA-RT-FUS–89-24			
RT/PAS–					
89-24	15:45465	*See* ENEA-RT-PAS–89-24			
89-27	15:45156	*See* ENEA-RT-PAS–89-27			
RT/TIB–					
88-50	15:45032	*See* ENEA-RT-TIB–88-50			
89-27	15:45033	*See* ENEA-RT-TIB–89-27			
89-30	15:45034	*See* ENEA-RT-TIB–89-30			
89-31	15:44026	*See* ENEA-RT-TIB–89-31			
89-32	15:45035	*See* ENEA-RT-TIB–89-32			
89-33	15:45036	*See* ENEA-RT-TIB–89-33			
89-34	15:45087	*See* ENEA-RT-TIB–89-34			
89-38	15:45037	*See* ENEA-RT-TIB–89-38			
89-49	15:46132	*See* ENEA-RT-TIB–89-49			
89-54	15:45038	*See* ENEA-RT-TIB–89-54			
RTI/STUDI-STRAT–					
88-4	15:44556	*See* ETDE-IT–90-47			
RTI/TIB–					
89-19	15:44693	*See* ENEA-RTI-TIB–89-19			
89-25	15:46131	*See* ENEA-RTI-TIB–89-25			
RX-R–					
90011	15:45705	*See* AD-A–221059/9/XAB			
90012	15:45711	*See* AD-A–221816/2/XAB			
Risley-Trans–					
5923	15:44348	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90637003	
SAIC–					
86/6054-SAN	15:44604	*See* AD-A–221221/5/XAB			
SAND–					
88-1221	15:43992	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014853	MF-814
88-3158-Rev.	15:46314	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014850	MF-905
89-1135	15:44341	*See* NUREG/CR–5373			
89-2101/3	15:44349	NTIS, PC A99/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014861	MF-610
89-2284C	15:45180	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016225	MF-706
89-2587C	15:45176	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015846	MF-707
89-3009C	15:45193	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015564	MF-706
89-3010C	15:44350	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012753	
89-3096C	15:44351	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012755	
89-3100C	15:44972	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015141	MF-706
89-3104C	15:44352	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012240	MF-700
89-3105C	15:44353	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90012151	
90-0086C	15:44982	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012922	MF-406
90-0091C	15:44878	NTIS, PC A02/MF A01 - OSTI		DE90011024	MF-701
90-0109C	15:44810	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015702	MF-701
90-0113C	15:44354	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015166	MF-700
90-0114C	15:44235	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015140	MF-523
90-0189C	15:46054	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016217	MF-706; MF-704
90-0645	15:44699	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014851	MF-705
90-0743C	15:46315	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015170	MF-705
90-0776	15:44973	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014854	MF-512
90-0800C	15:44939	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015394	MF-706
90-0882C	15:45218	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016108	MF-704
90-0883C	15:44649	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016105	MF-704
90-0910C	15:46240	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015207	MF-712
90-0985C	15:46316	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90010823	MF-706
90-0986C	15:45205	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011227	MF-706
90-1002C	15:46241	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015840	MF-706
90-1006C	15:44650	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015693	MF-704
90-1071C	15:43993	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015208	MF-721
90-1084C	15:44857	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015830	MF-704
90-1166C	15:45053	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015565	MF-706
90-1243C	15:45141	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016223	MF-712
90-1268C	15:45142	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016224	MF-712
90-1317	15:45660	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014864	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SAND–					
90-1335C	15:44651	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011910	MF-704
90-1366C	15:44355	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90011903	
90-1383C	15:44958	NTIS, PC A03/MF A01 - OSTI		DE90011023	
90-1442C	15:45732	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015699	
90-1466C	15:45109	NTIS, PC A02/MF A01 - OSTI		DE90016221	MF-705
90-1522	15:45143	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014867	MF-706
90-1551C	15:46317	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015717	MF-706
90-1639C	15:44700	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015700	MF-701
90-1660C	15:44017	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90012760	MF-700
90-1680	15:44974	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014860	MF-406; MF-405
90-1693C	15:44652	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013875	MF-704
90-1694C	15:44653	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013498	MF-114
90-1845C	15:45054	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015697	MF-706
90-1924C	15:45181	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015209	MF-706
90-1944C	15:45055	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014946	MF-706
90-1955	15:44975	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014866	MF-607
90-1959C	15:46163	NTIS, PC A03/MF A01; OSTI; INIS		DE90015164	MF-420
90-1963C	15:45144	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016218	MF-712
90-2036C	15:46318	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015391	MF-705
90-2048C	15:45056	NTIS, PC A02/MF A01 - OSTI		DE90015395	MF-705
90-2058C	15:44811	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015696	MF-704
90-2066C	15:46319	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016103	MF-705
90-2067C	15:46320	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016102	MF-705
90-2120C	15:44061	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015695	MF-704; MF-706
90-2129C	15:44976	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015566	MF-706
90-2130C	15:44134	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015567	MF-706
90-2135C	15:44654	NTIS, PC A03/MF A01 - OSTI		DE90015694	MF-701; MF-704
90-2145C	15:43694	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015780	MF-108
SCIENTIFIC–					
1	15:44609	*See* AD-A–221768/5/XAB			
1	15:45664	*See* AD-A–221188/6/XAB			
2	15:45663	*See* AD-A–221006/0/XAB			
SCPRI-RM–					
11-1989	15:45325	NTIS (US Sales Only), PC A03/MF A01		DE90514567	
SERI/TP–					
211-3896	15:44135	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000365	MF-273
211-3904	15:44136	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000360	MF-271
211-3907	15:44137	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000358	MF-273
211-3909	15:44138	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000362	MF-273
211-3914	15:44139	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000363	MF-273
254-3799	15:44168	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000343	MF-261
255-3537	15:44515	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000334	MF-316
SGD–					
548-PT-1	15:45676	*See* PB–90-226028/XAB			
548-PT-2	15:45677	*See* PB–90-226036/XAB			
SKB-TR–					
89-36	15:43994	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637313	
90-01	15:45348	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90636638	
90-04	15:44236	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637081	
90-07	15:44221	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637066	
SLAC–					
351	15:45875	NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014832	PC-414
360	15:45804	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014869	PC-414
367	15:45805	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014870	PC-414
SLAC-PUB–					
5218	15:45876	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014808	MF-414
5260	15:46333	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014806	MF-405
SOL–					
90-10	15:46321	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016310	MF-405
SRD-R–					
502	15:44356	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636808	
503	15:43995	Available from UKAEA Culcheth (UK), price Pound 6.00			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
512	15:44357	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636809	
SSC–					
138	15:45111	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015211	MF-414
78	15:45110	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015210	MF-414
SSI–					
90-03	15:45177	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637250	
90-04	15:44358	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636798	
90-07	15:44359	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636799	
90-08	15:44305	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636805	
SSS-R–					
83-5906	15:44610	*See* AD-A–221820/4/XAB			
STA–					
89-04483	15:43804	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
STUDSVIK-NF(P)–					
89-34	15:44222	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637067	
STUDSVIK-NF(R)–					
89-83	15:44223	NTIS (US Sales Only), PC A07/MF A01; OSTI; INIS		DE90637068	
STUDSVIK-NF-P–					
88-32	15:44236	*See* SKB-TR–90-04			
89-35	15:44221	*See* SKB-TR–90-07			
SUPRI-TR–					
70	15:43790	*See* DOE/BC/14126–16			
74	15:43791	*See* DOE/BC/14126–20			
76	15:43792	*See* DOE/BC/14126–22			
77	15:43793	*See* DOE/BC/14126–25			
78	15:43794	*See* DOE/BC/14126–26			
SVF–					
361	15:44655	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636568	
TAC–					
CE02875	15:44995	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, CAN K1A 0R6. Prices: $175.00 CAN			
TR–					
0089(4940-06)-6	15:45707	*See* AD-A–221330/4/XAB			
2005-1F	15:44531	*See* PB–90-225608/XAB			
25-ONR	15:44375	*See* AD-A–221919/4/XAB			
312	15:46279	*See* AD-A–221678/6/XAB			
90-94	15:43754	*See* PB–90-233818/XAB			
TRB/TRR–					
1221	15:44529	*See* PB–90-224833/XAB			
1245	15:43924	*See* PB–90-239724/XAB			
TSI–					
CE03091	15:44206	PC Publications Ontario, 880 Bay St, 5th Floor, Toronto, ON, CAN M7A 1N8; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $5.28 CAN; MF $10 CAN			
TTI–					
2-10-89-2005-1F	15:44528	*See* PB–90-216417/XAB			
UAG-R–					
301	15:45658	*See* PB–90-231226/XAB			
UBA-FB–					
89-118	15:45630	Copy held by UB/TIB Hannover			
89-140	15:45631	Copy held by UB/TIB Hannover			
UCB-NE–					
4145	15:44004	*See* LBL–27045			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
UCD–					
472-135	15:45603	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014822	PC-408
UCRL–					
101555	15:45057	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015202	MF-712
101627	15:44433	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015191	MF-706
101768	15:46242	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016473	MF-712
101945-Rev.1	15:46243	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90011483	MF-706
101945-Rev.2	15:46244	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90013478	MF-712
102115	15:44011	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015613	MF-814
102335	15:44702	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015205	MF-701
102337	15:44656	NTIS, PC A02/MF A01 - OSTI		DE90016477	MF-404
102468	15:45206	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015612	
102523	15:45542	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015038	MF-706
102625	15:45232	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015119	MF-706
102705	15:44018	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015206	MF-706
102786	15:46050	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015608	MF-705
102845-Rev.1	15:44812	NTIS, PC A03/MF A01 - OSTI		DE90015188	MF-704
102955	15:45684	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015198	MF-700
21008-Vol.1	15:45632	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015409	
21008-Vol.8	15:45512	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015410	
53859-89	15:44428	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014825	PC-104; PC-109; PC-122; PC-123;
94136	15:44701	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015362	MF-704
UCRL-CR–					
103416	15:45326	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015611	MF-702
103554	15:45685	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015815	MF-706
104084	15:45349	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015609	MF-703
104144	15:45194	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015817	
104314	15:45219	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015405	
104380	15:46245	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015602	MF-421
104449	15:46164	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015771	MF-712
104490	15:45327	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015408	MF-402
104533	15:45661	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015816	
104583	15:46113	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016213	MF-706
104622	15:46334	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015748	
UCRL-ID–					
103344	15:45733	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014831	
103495-89	15:44961	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014797	MF-706
104341	15:44977	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90014798	MF-706
104441	15:46246	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90014862	MF-423
104689	15:46322	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016654	MF-705
UCRL-JC–					
102565	15:45058	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015194	MF-706
103327	15:45059	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015617	MF-706
103410	15:45633	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015406	
103563	15:45982	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015204	MF-741
103603	15:45220	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015149	MF-706
103606	15:44480	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015146	MF-700
103919	15:46165	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015618	MF-712
104159	15:46247	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015365	MF-700
104189	15:44657	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015189	MF-704
104190	15:44658	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015190	MF-704; MF-701
104204	15:44978	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015147	MF-706
104205	15:44659	NTIS, PC A02/MF A01 - OSTI		DE90015199	MF-706
104238	15:45734	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90015366	MF-700
104241	15:46166	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015187	MF-700
104337	15:45195	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015619	MF-706
104339	15:45686	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015620	MF-706
104362	15:44979	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015120	
104455	15:46248	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015615	MF-706
104456	15:46249	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015203	MF-706
104457	15:46250	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015201	MF-706
104478	15:45196	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015610	MF-706
104603	15:45687	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015616	MF-700
104606	15:46167	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015195	MF-700
104630	15:46323	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015614	MF-705
104643	15:45112	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015607	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
104693	15:46324	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90016478	MF-405
UCRL-LR–					
103745	15:46325	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015603	MF-700
104227	15:46269	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015596	MF-700
UKNDC(89)-P–					
116	15:46036	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90636343	
UM-P–					
88/111(rev.)	15:45877	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635696	
89/102	15:46119	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90635664	
89/105	15:44813	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636629	
89/106	15:46087	NTIS (US Sales Only), PC A02/MF A01; OSTI; INIS		DE90636261	
89/110	15:45881	NTIS (US Sales Only), PC A04/MF A01; OSTI; INIS		DE90635697	
89/31	15:45178	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90637251	
89/37	15:45735	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635730	
89/39	15:45846	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635724	
89/43	15:45942	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90636389	
89/47	15:46114	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635665	
89/52	15:45878	NTIS (US Sales Only), PC A03/MF A01; OSTI; INIS		DE90635698	
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89-234	15:43996	NTIS, PC A03/MF A01; OSTI; INIS; USGS Books and Open-File Reports Section, Box 25425, Denver, CO 80225-0425; GPO Dep.	E 1.99:	DE90015533	MF-814
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90-03960	15:44090	PC Dept. of Industry, Science and Technology (ISTC), Library (CLIB), 235 Queen St., Ottawa, ON, CAN K1A 0H5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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0818	15:44000	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90015376	MF-940

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ZE–C0874074	15:43903	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20-C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

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DE90015655	DOE/ER/25013–5

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DE90015669	DOE/PC/90529–T3
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DE90015690	DOE/FE/61811–T7
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DE90015702	SAND–90-0109C
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DE90015708	ORNL/Sub–85-27412/5-P1
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DE90015745	MLM–3649(OP)
DE90015746	MLM–3650(OP)
DE90015747	MLM–3651(OP)
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DE90015768	ORNL/FTR–3686
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DE90015785	ORNL/RASA–90/4
DE90015787	CONF-900450–9
DE90015788	CONF-9007141–2
DE90015789	CONF-9005233–3
DE90015790	CONF-901071–7
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DE90015794	CONF-900958–2
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DE90015797	CONF-8905112–4
DE90015799	CONF-9008133–1
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DE90015802	ORNL/FTR–3690
DE90015803	ORNL/FTR–3701
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DE90015817	UCRL-CR–104144
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DE90015820	EGG-ESQ–8888
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DE90015826	DOE/ER/13569–5
DE90015830	SAND–90-1084C
DE90015833	ORNL/FTR–3710
DE90015834	ORNL/RASA–89/3
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DE90015836	ORNL/FTR–3695
DE90015837	PNL–6450-33-HEDR
DE90015839	ANL–90/21
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DE90015847	DOE/RL–88-20-Suppl.1
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DE90015849	NIPER–479-Vol.2
DE90015852	DOE/ER/40415–15
DE90015853	DOE/ER/45056–9
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DE90015858	DOE/EIA–0533
DE90015859	DOE/ET/10815–136
DE90015861	DOE/ER/60617–4
DE90015862	DOE/ER/60514–4
DE90015863	DOE/ET/10815–137
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DE90015935	DOE/ER/45253–5
DE90015965	CONF-890993–2
DE90015973	PNL-SA–17922
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DE90016002	DOE/S–0077P
DE90016004	DOE/IE–0018
DE90016008	DOE/MA–0409
DE90016010	DOE/EIA–0520(90/07)
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DE90016015	CONF-8907113–14
DE90016016	CONF-881185–2
DE90016020	CONF-900814–7
DE90016026	CONF-9002111–2
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DE90016031	CONF-900466–80
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DE90016038	CONF-900936–1
DE90016039	CONF-901034–1
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DE90016120	DOE/ER/40537–1
DE90016121	DOE/ER/40427–05-N90
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DE90016124	DOE/ER/60657–3
DE90016126	DOE/ER/13715–2
DE90016127	DOE/ER/25006–4
DE90016128	DOE/ER/25006–5
DE90016130	DOE/NE/37963–12
DE90016132	ORNL/FTR–3712
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DE90016192	DOE/ER/60870–1
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DE90016206	GA-A–15820
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DE90016224	SAND–90-1268C
DE90016225	SAND–89-2284C
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DE90016283	KCP–613-4326
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DE90016344	PNL-SA–17896
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DE90016430	KCP-613-4172
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DE90016443	LA-UR-90-2864
DE90016444	LA-UR-90-2861
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DE90016477	UCRL-102337
DE90016478	UCRL-JC-104693
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DE90016629	LBL-27568
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DE90513645	RERF-TR-4-88
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DE90513647	RERF-TR-17-89
DE90513706	RRK-90-2
DE90513707	RRK-90-3
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DE90513802	JAERI-M-90-060
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DE90513871	KURRI-TR-331
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DE90513927	KURRI-TR-324
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DE90514419	ETDE-IT-90-19
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DE90514537	IFP-37-310
DE90514538	AFME-84-350-0277
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DE90514541	FRNC-R-240
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DE90514543	AFME-86.91.0004
DE90514544	AFME-FR-2
DE90514545	AFME-FR-6
DE90514546	PIRSEM-3032
DE90514547	AFME-86-91.0003.1
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DE90514551	PIRSEM-0251
DE90514552	AFME-222.500
DE90514553	CONF-860433-
DE90514554	PIRSEM-0243.1
DE90514555	FRNC-TH-3599
DE90514563	CEPN-138
DE90514564	CEA-R-5513
DE90514565	CEA-R-5517
DE90514566	CEA-R-5514
DE90514567	SCPRI-RM-11-1989
DE90514568	CEA-CONF-9987
DE90514569	CEA-CONF-9986
DE90514570	LYCEN-89-02
DE90514609	CSNSM-T-89-51
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DE90514621	CRN-CPR–89-01
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DE90514649	CEA-CONF–10030
DE90514650	CEA-CONF–9983
DE90514651	CEA-CONF–10027
DE90514653	CEA-CONF–10021
DE90514654	CEA-CONF–10020
DE90514655	CEA-CONF–10019
DE90514683	CEA-N–2620
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DE90514704	FRCEA-TH–280
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DE90514714	CEPN–164
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DE90514741	CEA-CONF–9982
DE90517241	GSI–89-10
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DE90517360	GRS-F–185
DE90517364	KWU-R–917/86/013
DE90517426	GSF–16/89
DE90517427	GSI–90-1
DE90517429	ISI-B–2-90
DE90517430	KFK-PEF–66
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DE90615120	INIS-mf–11596
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DE90635696	UM-P–88/111(rev.)
DE90635697	UM-P–89/110
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DE90635701	UWThPh–1990-19
DE90635724	UM-P–89/39
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TH Thailand
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TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

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UG Uganda
US United States of America (USA)
UY Uruguay

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